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ARMY AVIATION

LUBE SYSTEMS

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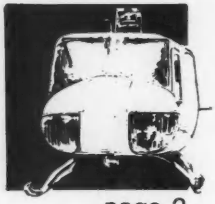

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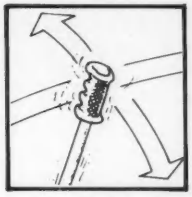

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Honorable John O. Marsh Jr.
Secretary of the Army

Richard K. Tierney
Editor

The mission of the *U.S. Army Aviation Digest (USPS 415-350)* is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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Articles, photos, and items of interest on Army Aviation are invited. Direct communication is authorized to Editor, *U.S. Army Aviation Digest,* P.O. Drawer P, Fort Rucker, AL 36362. Manuscripts returned upon request.

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OIL-PRODUCING countries have been making headlines lately by rolling back their prices on crude oil. Now, Army Aviation and its oil analysis program are making "front-page" news with the successful testing of a new chip detector and filter concept that will extend the oil change interval on our Army aircraft and conserve 5,000 gallons of oil for savings of at least $1.5 million annually.

Major General Story C. Stevens, commander of the Army Aviation Research and Development Command, tells us in this month's lead article about the new oil analysis concept. Tests over more than 70,000 hours in UH-1s have proven so successful that AVRADCOM is recommending that oil change intervals be extended to at least 1,000 hours from the current 100- to 300-hour period. While the test was limited to UH-1s, the new system is equally applicable to other helicopters.

As continues to be evident throughout the force, we are doing much better this year in our endeavors to be accident free. That's "headline" news in any publication and a great many people deserve credit for their efforts in our renewed assault on needless accidents. Indeed, Mr. G. Thomas White and his colleagues at the Applied Technology Labs at Ft. Eustis, VA, are to be commended for their efforts to isolate causes and develop cures for mast bumping. I recommend that you study Mr. White's article carefully, for as he points out, the mast bumping problem is still with us. In turn, awareness of the causes of mast bumping is a major deterrent to this problem. You should, therefore, take careful note of the engineering modifications that dictate the level of maneuverability safely achievable while flying nap-of-the-earth in combat environments.

And since when is good news a cause for concern? Dr. Sandra S. Martin of ARI and CW4 Lloyd Washer of MILPERCEN answer that question for us in the article "Aviation Warrant Officer Retention, A Continuing Effort." They point out that since the Army increased its awareness and attention to warrant officer attrition in FY 1979, the retention rate has steadily increased from less than 50 percent to more than 60 percent. Meanwhile the Army has greatly increased the annual training output of aviation warrant officers from only 200 in FY 1978 to 859 in FY 1983. Not only has this training increased the aviation warrant officer population, but by the same token, the proportionate number eligible to leave has increased accordingly. Thus, the potential losses in training dollars invested could approach $88 million per year or more than $100,000 per aviator.

Thus, any above normal attrition rate for aviation personnel is cause for concern. Army initiatives to enhance aviator retention over the past 4 years have been most successful. Dr. Martin and CW4 Washer discuss what was done, including how the Army Aviation Branch may affect future retention. A well-prepared and well-researched article that documents a people problem seen and dealt with in a timely and effective fashion. The end result is that we have recruited, trained and retained good people and they enjoy what they are doing in a challenging career—and remaining in the force in unprecedented numbers.

Thanks now to all of our readers for your tremendous response to the recent readership survey. Returns are still pouring in, and results are being tabulated, but one thing is clearly evident: "Hangar Talk" and the more recently created "Tower Talk" are extremely popular with our readers. CW2 (P) Gary Weiland, the author, covers AR 95-1, "Army Aviation: General Provisions and Flight Regulations" this month.

If you have not tested yourself in an earlier issue, I urge you to try this month's quiz on page 18. You may find that you need to get the "book" out and refresh a bit. But, you'll hardly be alone. According to our survey responses, a great many people at all levels of Army Aviation get the book out to review what they have forgotten after reading "Hangar Talk." That's the professional approach.

And finally, 15 April 1983 brought good news to the Army Aviation team—not in terms of an income tax return, though I hope many of you received a generous refund, but a formal announcement that the Secretary of the Army and the Chief of Staff on the 14th had approved the centralization of all aviation proponency at the Aviation Center and the establishment of Aviation as a Branch of the Army. This long awaited and much deliberated decision was received with great enthusiasm by aviators and crewmembers everywhere, commissioned and warrant officer, and enlisted, junior and senior. But the challenge is now ours as never before to make an even greater contribution to the combined arms team of our Army. Remember, one and all, that this decision, the establishment of the Branch, was made with that thought in mind—to provide our Army even more from Aviation than ever before. That is now our mission and there is no doubt that we can do so. The confidence of our leadership in the "Aviation Branch" and reposed in us will be reaffirmed many times over in the years to come. As Aviation team members, we will continue to strive for excellence!

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ARMY AVIATION LUBE SYSTEMS

TIME FOR A CHANGE

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MOST ARMY helicopter pilots have experienced that uncertain feeling that occurs when a chip detector light illuminates while in flight. Fortunately, most of the precautionary landings which result are later determined to have been unnecessary, but this does little to eliminate the tension during the landing. Most of the unnecessary aborts associated with chip detectors are due to a buildup of "normal fuzz" across the electrical contacts or a short circuit in the wiring. U.S. Army Aviation Research and Development Command's (AVRADCOM's) Applied Technology Lab (ATL) at Ft. Eustis, VA, has long been concerned with those and other related problems which produce high abort rates and excessive maintenance costs; e.g., ineffective diagnostics, too-frequent oil changes, high no-fault removals.

ATL is currently flight testing a new chip detector and filter concept for engines, transmissions and gearboxes which is showing great promise for virtually eliminating unnecessary chip detector aborts and greatly increasing bearing life while producing an extremely accurate diagnosis of the conditions of the oil-wetted components. This system, which consists of a new in-line chip detector and an extremely fine filter, has been flight tested in excess of 70,000 hours with outstanding effectiveness.

Those of us who have been around Army Aviation for a while recognize a need for sophistication in the use of lubricating oils, particularly in the areas of condition monitoring of the oil-wetted components and of overall oil utilization. Although we use chip detectors and spectrometric analysis for diagnostic purposes, each of these has severe limitations. The chip detectors are not scientifically or strategically located; therefore, they have a very poor collection efficiency in addition to producing false indications. The spectrometer is limited in its diagnostic capability for helicopter application in that it can only deal with particles less than 8 microns, which are of little or no value from a diagnostic standpoint. Coupled with these spectrometer limitations, the problems experienced in the logistics (sample-taking, delivery to lab, analysis, call or message from the lab in case a problem is found) cause that program to be of limited value.

As a result of these diagnostic problems, Army Aviation experiences a no-fault removal rate of engines, transmissions and gearboxes of about 35 percent.

Historically, we have changed the oil in our UH-1 Huey engines and transmissions every 100 and 300

hours, respectively. These oil change intervals were undoubtedly established when the aircraft were new. Little was known about component life expectancies and frequent oil changes were reasonable. Aircraft maturity should have caused an extension in these oil change intervals. Air Force and Navy turbine engine and gearbox oil change intervals are an order of magnitude greater than that for Army Aviation components.

It has been recognized for many years that lubricating oil could provide important information relative to the mechanical condition of oil-wetted components, and that, of course, is the reason for the installation of chip detectors and use of the Army Oil Analysis Program (AOAP) process mentioned above. The question to be addressed is what is the best, most effective way of receiving and analyzing this information. Under the ATL Oil Debris Monitoring Program, a wide variety of diagnostic techniques have been investigated. These techniques include the use of capacitive devices, radioactive devices, filter interrogating devices and advanced chip detectors, all of which were designed to give an indication of the quantity of metal in the oil. During the course of work being accomplished by ATL, in-house and under contract, it became evident that the size of the metallic particles in the oil, as well as the quantity, was significant. It was recognized that large particles (those of 20 microns and greater in size) are significantly more important than those particles of a smaller size. During this same period of time, work conducted by AVRADCOM's Propulsion Laboratory and others showed the importance of clean oil on component fatigue life. These tests showed that components operating in an oil system with a 3-micron filter had a fatigue life of about five times that of components operating in an oil system with a 40-micron filter. The lubricating systems on current Army aircraft (except the T-700 engine) have filters ranging from about 40 to 80 microns in size.

In 1978, ATL, with two objectives, initiated an ongoing flight test program at Ft. Rucker, AL. These objectives were to prove the effectiveness of an advanced helicopter oil-wetted component debris discrimination and filtration system and to acquire sufficient data to convince the Army to extend the oil change interval on its aircraft engines and transmissions to at least 1,000 hours. This program involves a fleet of UH-1 helicopters of the U.S. Army Aviation Center at Ft. Rucker with onsite support from the Aviation Development Test Activity (ADTA) and is the culmination of a number of research efforts involving oil-wetted component particle analysis, filtration studies and component reliability assessments. The 50 aircraft in the program were divided into a 12-aircraft control fleet and a 38-aircraft test fleet. The control aircraft and the maintenance performed on them were not modified in any manner other than eliminating lubricating oil changes. The test fleet had 3-micron filters and new, full-flow, fuzz-discriminating, chip detectors built by TEDECO installed on both engines and transmissions. No oil changes were made on the test fleet.

The primary features of this new chip detector are its extremely high collection efficiency due to its design and location in the oil line and its capability to detect normal fuzz and/or chips of insignificant size, but not cause the illumination of the chip light. Fuzz discriminating chip detectors were installed in both the 42- and 90-degree gearboxes on the test fleet as well.

Early in the program, several minor redesigns and modifications of the system were required to produce reliable, effective operation. One of these changes involved minor revisions to the chip detector gap which, of course, influences the sensitivity of the chip detector system. Another modification required, and which has interesting implications, was the redesign of the bypass arrangement on the filter housings. It was discovered on cold starts when the filter went into bypass it would cause the regurgitation of previously trapped debris. Although this was first noticed on test aircraft, the filter head was standard and had not been modified in any way. This implies that the filter design of every UH-1 and AH-1 Cobra flying today allows all filtered debris to be reinserted into the lubrication system upon a cold start of the aircraft. Filter head modifications on the test fleet resolved the problem. At this writing, the test fleet has logged in excess of 70,000 hours, 50,000 of which have been flown since the filter bypass redesign.

The transmisson lube system schematic at figure 1 shows that the standard cleanable filter, having a rating of 80 microns, has been replaced by the new chip detector in the test installation. In addition, it can be seen that the 3-micron filter replaces the standard external filter having a 38-micron rating.

The engine lube system schematic is illustrated in figure 2. The chip detector is installed in the scavenge line directly after the pump with the 3-micron filter located between the chip detector and the oil cooler.

As shown in figure 3, the overall organization of the program is comprehensive and incorporates the capabilities of a number of organizations. The procedures used during the flight test program were such

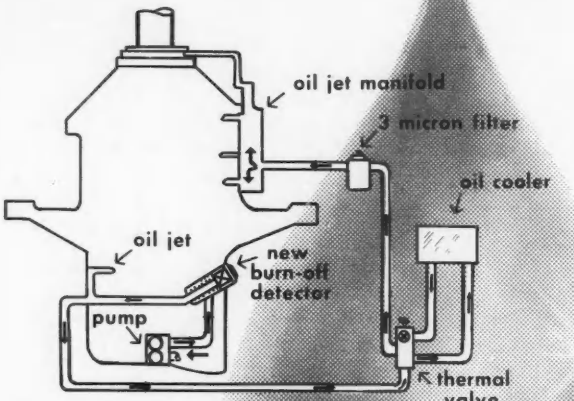


FIGURE 1: Transmission oil system schematic

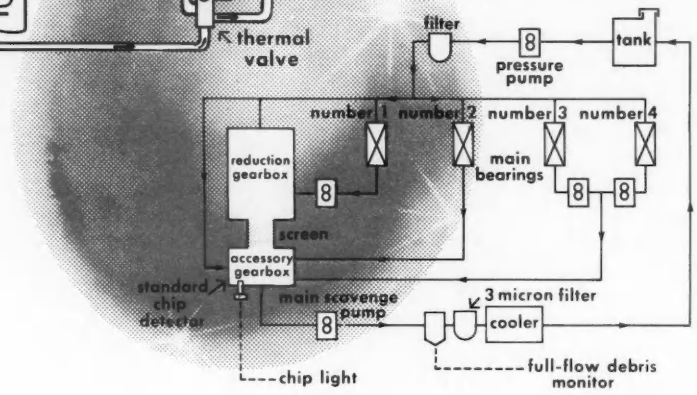


FIGURE 2: T-53 engine schematic with full-flow debris monitor

that upon the occurrence of a chip light, the chip detector was removed from the aircraft and replaced with a spare. The removed chip detector was then sent to the AOAP lab at Ft. Rucker for analysis, photographing and cleaning. The debris was then sent to the Joint Oil Analysis Program (JOAP) lab at Pensacola Naval Air Station, FL, where it was classified, photographed and retained. In cases of severe contamination, the filter was also removed from the aircraft and the debris analyzed.

Oil samples were taken from both test and control aircraft every 50 hours. They were subjected to AOAP analysis and then sent to the Naval Air Propulsion Test Center in Trenton, NJ, for physical and chemical analysis of the oil.

Engines and transmissons which were removed for metal contamination were followed by teardown inspections accomplished at ADTA and the condition of the oil-wetted components documented. In addition, certain other engines and transmissions which were removed for reasons other than metal contamination, e.g., foreign object damage, oil leakage, etc., were also subjected to teardown inspection with the results documented. This process provided, for the first time, feedback information on the condition of engines and transmissions which had been identified by chip indications as having failures in progress. It also allowed feedback information on the general interior condition of the oil system of engines and transmissions which had been operated without oil changes for long periods of time, both with standard filtration and the 3-micron filtration.

The results of this program have been outstanding. Samples of oil taken from engines and transmissons operating up to 2,000 hours have shown that the oil condition is not measurably affected and, in fact, the

2,000-hour oil still met new oil specifications, regardless of the level of filtration.

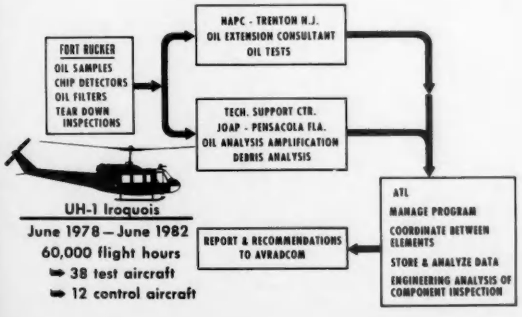
The 3-micron filters had a very strong, positive effect on the condition of the interior of the engines and transmissions. Numerous comments were recorded by disassembly personnel regarding the overall cleanliness of the interiors and the excellent condition of the wear surfaces.

To date, 6 transmissions and 13 engines have been removed from the test fleet for metal contamination. All removals were preceded by numerous chip indications, generally covering 100 or so hours of operation. Each removal was confirmed during the teardown analysis as having failures in progress which would produce chips. Conversely, none of those engines and transmissons which were removed for reasons other than metal contamination, but were subjected to teardown analysis, were found to have such failures in progress. In addition, none of the removals for metal contamination were indicated by the Spectrographic Oil Analysis Program, which is understandable since the 3-micron filters remove virtually everything of AOAP interest from the oil.

Only three chip lights have been experienced on the 42- and 90-degree gearboxes, with no removals performed for metal contamination. This is dramatic evidence of the ineffectiveness of standard gearbox chip detectors and their contribution to false removals and aborts. The current fleet averages a gearbox chip light every 500 hours.

The program has demonstrated that the full-flow debris monitoring, using a fuzz discriminating capability and ultrafine filtration, produces a superior diagnostic system and operating environment for oil-wetted components. The system has been 100 percent effective in detecting failures of oil-wetted components in engines and transmissions. It has also been 100 percent effective in not producing false alarms or no-fault removals. Explicit removal criteria have been developed for the transmisson. Removal criteria for the engine are not as well developed and that process is being continued. Further data is being gathered on these engine chip detectors and on chip detectors having design refinements.

FIGURE 3: Oil debris monitoring and fine filtration progam



Based on the failure detection reliability of the system tested and the substantial time periods over which chip indications occur prior to a failure, AVRADCOM has recommended that such a system be installed on all UH-1 and AH-1 aircraft and that the chip lights be moved from the cockpit to a maintenance advisory panel. Such action would eliminate mission aborts due to false chip lights and would have no effect on flight safety. It has also been recommended that the transmission be placed in an on-condition maintenance status.

The results of this program lead to the conclusion that the oil change interval in the existing fleet should immediately be extended to at least 1,000 hours and ATL is of the opinion the oil should be placed in an on-condition status. The on-condition argument can be supported very easily by the current availability of simple, easily applied test measures to determine the acidity and viscosity of the oil at the aircraft site.

The substantial benefits of the implementation of the results of this work are immediately obvious. The virtual elimination of no-fault removals of engines, transmissions and gearboxes will produce large benefits in such important areas as reduced component overhauls with the associated maintenance man-hours per flight hour, provide substantially increased MTBRs (mean time between (engine) removals), reduced spares/pipeline costs and a substantial increase in aircraft availability. It has been calculated that nothing more complicated than extending the oil change interval produces a savings of 57,000 gallons of oil ($1.5 million). A cost effective analysis has been performed on the installation of the tested system on the UH-1 and AH-1 fleet which indicates a payback of initial investment in about 18 months.

Although the program outlined herein relates to the UH-1 aircraft, the lessons learned can be directly applied to other helicopters. Certain peculiar wear modes of engines and transmissions must be considered, but proper integration of the diagnostic system into the lubrication system will be effective and extremely productive, and should be undertaken.

AVIATION WARRANT OFFICER RETENTION

A CONTINUING EFFORT

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ON FISCAL YEAR 1979 MILPERCEN noted a trend toward decreased retention of AWOs. Retention data indicated that, for those AWOs who had graduated from flight training in FY 1976 and FY 1977T[1] and who were eligible to leave the Army in FY 1979, retention beyond initial obligation was about 45 percent. In contrast, during the 3 previous years, retention of AWOs at the same career point had remained relatively constant at about 65 percent (figure 1).

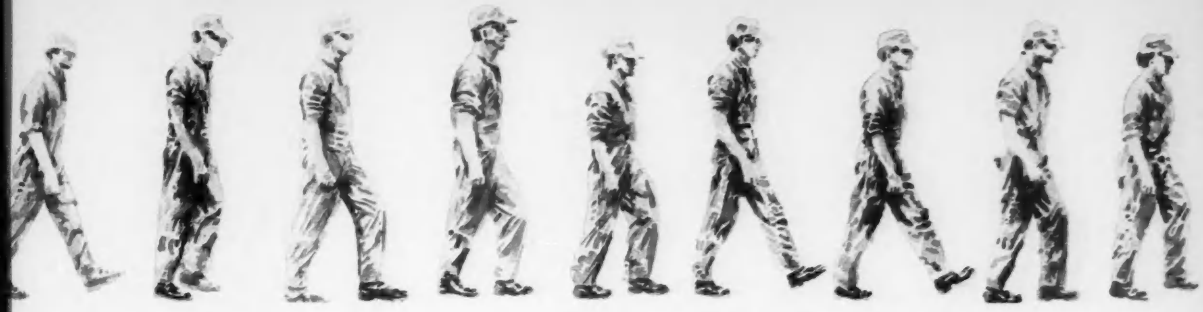
MILPERCEN was concerned that, if the high rate of AWO separation continued, Army Aviation's readiness and combat effectiveness would be seriously reduced. This concern prompted MILPERCEN to request that ARI provide research support to investigate AWO attrition. In response to the request, ARI conducted a worldwide survey of Army aviators that identified the demographic characteristics and career factors that contribute to AWO attrition.

The 10 factors that AWO attritees who participated in the survey identified as having the most influence on their decisions to leave the Army are shown in figure 2. These factors subsequently became the focus of a series of initiatives developed by MILPERCEN to improve retention of AWOs. Major initiatives included

GLOSSARY

AFS	active federal service	**FY**	fiscal year
ARI	Army Research Institute	**HQDA**	Headquarters, Department of the Army
ATM	aircrew training manual	**IERW**	initial entry rotary wing
AWO	aviation warrant officer	**MILPERCEN**	Military Personnel Center
DA	Department of the Army	**PERSACS**	Personnel Structure and Composition System
DCSPER	Deputy Chief of Staff for Personnel	**PMOS**	primary military occupational specialty
DOD	Department of Defense	**POI**	program of instruction
DTD	Directorate of Training Developments	**TDY**	temporary duty
FAC	flight activity category	**USAAVNC**	U.S. Army Aviation Center
FM	field manual		

[1] Beginning with FY 1977, the fiscal year was changed from 1 July through 30 June to 1 October through 30 September. FY 1977T represents the period 1 July 1976 through 30 September 1976 during which the transition to the new fiscal year concept occurred.



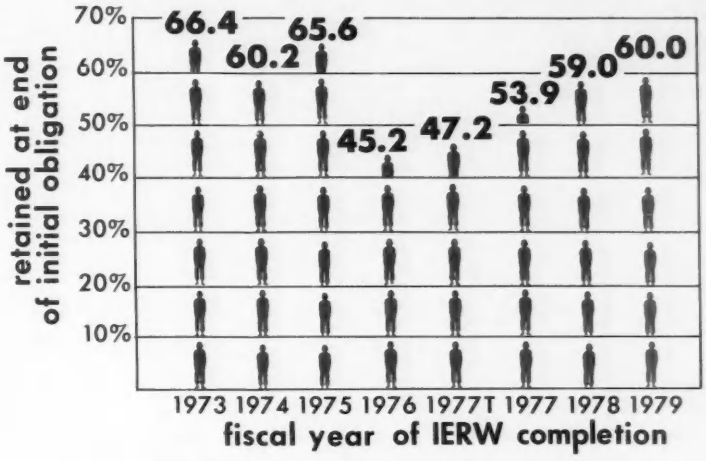
in the series are summarized in figure 3. The research and the resulting initiatives were described in detail in a series of *Aviation Digest* articles published in 1981 (August, September, November and December). Copies can be obtained by writing to: Editor, *Aviation Digest,* P.O. Drawer P, Ft. Rucker, AL 36362.

Impact Of The Initiatives

Since initiation of the AWO retention effort in FY 1979, retention of AWOs has steadily increased. In general, the increases in retention correspond with the Army's efforts to improve AWO retention.

During FY 1980, the first year of the retention effort, retention of first-term AWOs increased from 47.2 percent to 53.9 percent (figure 1). Although ARI's survey did not

FIGURE 1: Retention of AWOs at the end of initial obligation



(The fiscal year shown is the year of flight school completion. The end of initial obligation for the AWOs included in this figure was 3 years after flight school completion.)

FIGURE 2: Career factors influencing AWOs' decisions to leave the Army

Attritee RANK ORDER	CAREER FACTOR
1	Unequal flight pay (warrant officer flight pay versus commissioned officer flight pay)
2	Lack of concern for the individual
3	Low pay (all pay and allowances)
4	Erosion of benefits
5	Lack of competence in aviation matters by chain of command
6	Lack of professional respect and recognition from commissioned officers
7	Lack of opportunity for desirable installation assignment
8	Lack of leadership
9	Potential for higher paying aviation-related position outside of the Army
10	Lack of predictability of future in the Army

FIGURE 3: Retention initiatives

Area Of Concern	Initiatives
Pay and Benefits	Equalization of flight pay
	Increase in base pay
	Concurrent travel allowances
	Field grade housing
	Proposed pay step increases for warrant officers with more than 20 years AFS
Assignment and Career Management	Reorganization of Aviation Assignments Branch so that assignments are controlled by PMOS
	Expansion of Professional Development Branch to include long-term planning for the Warrant Officer Corps
	Warrant officer representation on the DCSPER staff
	Additional skill identifier (ASI 4A) to assign Warrant Officer Senior Course graduates to selected positions
	Proposal for a single promotion system
Professional Development	Expanded opportunity for aircraft transition training
	Increased quota for Warrant Officer Associate Degree Program
	Inclusion of CW3s(P) and CW4s in the zone of consideration for the Warrant Officer Senior Course
	Revision of Aviation Warrant Officer Advanced Course to include training for additional duties
	Modification of requirements for civilian education programs to include Regular Army warrant officers with up to 25 years AFS
	Proposal for funding to permit attendance of the Aviation Warrant Officer Advanced Course as a TDY with return to home station

begin until September 1980, a great deal of publicity about the overall retention effort preceded the survey. In addition, a number of preliminary surveys were conducted prior to the more extensive survey. Thus, it can be assumed that, throughout FY 1980, AWOs were generally aware of the Army's interest in them.

A further increase in retention occurred in FY 1981, during which 59 percent of the AWOs who completed their initial obligation remained in the Army. The additional increase in AWO retention corresponds with the conduct of the ARI survey, publication of its findings and an 11.7 percent increase in base pay. A 60 percent retention rate in FY 1982 indicates that the overall increase in AWO retention is a relatively stable one.

Feedback from individuals in the field suggests that the continued increase in AWO retention is due, in part, to the retention initiatives that were enacted during FY 1982. In addition, there is evidence that the decline in the economy during recent years has limited the availability of civilian jobs. The decreased chances of finding a civilian job might have encouraged retention of AWOs who would have chosen to leave the Army.

Reasons For Continuing Concern

Figure 1 shows that the current rate of AWO retention approximates a level that was considered for many years to be acceptable. However, despite the recent improvement in

retention rate, there are reasons for continuing concern about AWO retention.

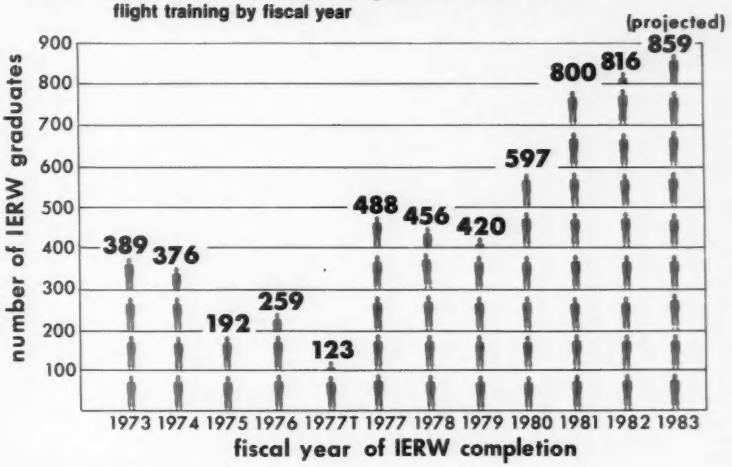
Increased AWO Training Rate. In response to the high AWO separation rate and increasing aviation force structure requirements, HQDA directed the Aviation Center to increase the AWO training rate at Ft. Rucker from 192 in FY 1975 to 816 in FY 1982, with 859 projected for FY 1983. Figure 4 illustrates the dramatic increase in AWOs trained at Ft. Rucker over the past few years.

The high training rate necessary to meet the Army's increasing aviation requirements is the primary reason for the Army's continued concern about future retention of AWOs. That is, due to the high training rate, the Army must reexamine the acceptability of a 60-percent first-term retention rate. Figure 5 illustrates the projected loss of AWOs that can be expected over the next 4 years if the first-term retention rate remains at 60 percent.

While the higher training rate increases the number of AWOs who remain in the Army, it also increases the number of AWOs who leave the Army—*even with the improved rate of retention.* In FY 1979, when retention rate for first-term AWOs was 45.2 percent, the Army lost 142 AWOs at the end of initial obligation.[2] **(Note:** 142 represents 54.8 percent of the 259 AWOs who were trained in FY 1976.) As indicated in figure 5, the Army can expect to lose 1,229 AWOs between FY 1984 and FY 1987—i.e., 40 percent of the 3,072 AWOs who are trained in the FY 1980 to 1983 timeframe.

[2]The initial obligation was changed from 3 to 4 years effective 1 October 1978.

FIGURE 4: Number of Active Army AWO graduates from IERW flight training by fiscal year



Source: Programs Branch, Directorate of Training and Doctrine, USAAVNC, January 1983.

FIGURE 5: Projected number of AWO losses FY 1984-1987

Flight School Completion	Number of AWOs Trained[a]	Projected First Term Retention	End of Initial Obligation	Expected Retention	Expected Attrition
FY 80	597	60%	FY 84	358	239
FY 81	800	60%	FY 85	480	320
FY 82	816	60%	FY 86	490	326
FY 83	859 projected	60%	FY 87	515	344
Total	3,072			Total	1,229

[a]The training output figures are Active Army only

The continuing AWO retention problem becomes of even greater concern when the losses are viewed in terms of training replacement costs. The cost of replacing an AWO who leaves the Army is estimated from the cost of training a new

FIGURE 6: FY 1979 estimated minimum replacement cost of a UH-1 trained aviation warrant officer

Cost of IERW[a,b]	Years of Service as Aviator (Initial Obligation)	FAC 1 Annual Flight Hour Requirements[c]	DOD Estimated Cost Per Flight Hour[d]	Annual Cost of Proficiency Training (Col 3 x Col 4)	Cumulative Cost of Proficiency Training (Cumulative Total of Col 5)	Total Cumulative Cost of Training (Col 1 + Col 6)[e]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
$121,431	1	96	$235	$22,560	$22,560	$143,991
121,431	2	96	235	22,560	45,120	166,551
121,431	3	96	235	22,560	67,680	189,111

[a] The estimated cost is based on actual FY 1979 training costs expressed in FY 1981 dollars.

[b] The reported cost is provided by Directorate of Resource Management, USAAVNC.

[c] The reported hours represent the minimum number of flight hours that the ATM (TC 1-135, January 1979) requires annually for an FAC 1 aviator.

[d] The reported cost represents DA's FY 1979 estimates of the hourly reimbursement rates for DOD users (from FM 101-20, January 1979). Flight hour costs for a specific installation may differ from the DA estimates.

[e] The totals do not include the additional training costs incurred by the qualifications listed below. If the aviator has any of these qualifications, the appropriate training cost(s) must be added to the reported totals.

Instructor Pilot Course (IP)	$21,065
Rotary Wing Instrument Flight Examiner Course (IFE)	$18,381
Aviation Maintenance Officer Course (AMOC)	$16,480
Aviation Safety Officer Course (ASO)	$2,858
Aviation Warrant Officer Advanced Course (AWOAC)	$17,359

FIGURE 7: FY 1983 estimated minimum replacement cost of a UH-1 trained aviation warrant officer

Cost of IERW[a,b]	Years of Service as Aviator (Initial Obligation)	FAC 1 Annual Flight Hour Requirements[c]	DOD Estimated Cost Per Flight Hour[d]	Annual Cost of Proficiency Training (Col 3 x Col 4)	Cumulative Cost of Proficiency Training (Cumulative Total of Col 5)	Total Cumulative Cost of Training (Col 1 + Col 6)[e]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
127,173	1	96	$332	$31,872	$31,872	$159,045
127,173	2	96	332	31,872	63,744	190,917
127,173	3	96	332	31,872	95,616	222,789
127,173	4	96	332	31,872	127,488	254,661

[a] The estimated cost is based on actual FY 1981 training costs expressed in FY 1983 dollars.

[b] The reported cost is provided by Directorate of Resource Management, USAAVNC.

[c] The reported hours represent the minimum number of flight hours that the ATM (TC 1-135, January 1981) requires annually for an FAC 1 aviator.

[d] The reported costs represent DA's FY 1983 estimates of the hourly reimbursement rates for DOD users (from HQDA Message, DALOAV 0815107, October 1982). The costs do not include operation and maintenance crewmen hourly per diem rates. Flight hour costs for a specific installation may differ from the DA estimates.

[e] The totals do not include the additional training costs incurred by the qualifications listed below. If the aviator has any of these qualifications, the appropriate training cost(s) must be added to the reported totals.

Instructor Pilot Course (P)	$19,077
Rotary Wing Instrument Flight Examiner Course (IFE)	$22,921
Aviation Maintenance Officer Course (AMOC)	$16,997
Aviation Safety Officer Course (ASO)	(FY 83 cost not available)
Aviation Warrant Officer Advanced Course (AWOAC)	$22,448

aviator to a comparable level of proficiency. An AWO who separated from the Army at the end of initial obligation in FY 1979 represented a *minimum* training replacement cost of $189,111 (figure 6). An AWO trained in FY 1983 will represent a minimum training replacement cost of $254,661 at the end of initial obligation (figure 7). Thus, the loss of 142 AWOs in FY 1979 represented a total loss of about $27,000,000 (142 AWOs multiplied by $189,111 training cost per aviator; figure 8). In contrast, the projected loss of 344 aviators in FY 1987 will represent a total loss of about $88,000,000 (344 AWOs multiplied by $254,661 training cost per aviator). Since the projections of future losses are not based on inflated dollars and do not include the costs of additional aircraft qualification courses, the actual loss represented by these aviators will be much greater than $88,000,000.

Aging Of The Force. Continued concern with retention is further supported by MILPERCEN's current projections of losses due to "aging of the force" (figure 9). Aging of the force refers to the large number of AWOs in the current inventory who are approaching 20-year retirement eligibility. The losses shown in figure 9 are based on FY 1982 retention data that indicate an annual loss rate of 24 percent for those AWOs remaining past 20 years of service. However, the historical loss rate of 36 percent for AWOs past 20 years of service suggests that the actual losses due to early retirement may be even greater than the predicted losses. The problem is serious in the face of increasing authorizations and requirements for AWOs (figure 10).

FIGURE 8: Estimated number and training replacement cost of AWOs who leave the Army at the end of initial obligation

Flight School Completion	Number of AWOs Trained[a]	End of Initial Obligation	Percent Attrition	Number of AWOs Who Leave (Col 2 x Col 4)	Estimated Minimum Training Replacement Costs[c]
FY 1976	259	FY 1979	54.8	142	$27,000,000
FY 1977T	123	FY 1979	52.8	65	12,000,000
FY 1977	488	FY 1980	46.1	225	43,000,000
FY 1978	456	FY 1981	41.0	187	35,000,000
FY 1979	420	FY 1982[b]	40.0	168	32,000,000
FY 1980	597	FY 1984[b]	40.0 projected	239	61,000,000
FY 1981	800	FY 1985	40.0 projected	320	81,000,000
FY 1982	816	FY 1986	40.0 projected	326	83,000,000
FY 1983	859 projected	FY 1987	40.0 projected	344	88,000,000

a The training output figures are Active Army only.

b Due to the transition from a 3-year to a 4-year initial obligation, effective 1 October 1978, few first-term AWOs are eligible to leave the Army in FY 1983.

c The training costs for first-term AWOs who left the Army in FY 1979 through FY 1982 are based on FY 1979 IERW and proficiency training costs. The training costs for first-term AWOs who are projected to leave the Army in FY 1984 through FY 1987 are based on FY 1983 IERW and proficiency training costs.

An additional concern about the predicted losses due to aging of the force is the loss of aviation experience. The AWOs currently approaching 20-year retirement eligibility are from the Vietnam era and thus have a vast amount of aviation experience, including combat experience. Even if only 24 percent of these AWOs leave the Army each year, once they reach retirement eligibility, the inventory of experienced aviators will be seriously reduced. The reduction in experience could have a serious impact on the Army's readiness for future combat.

FIGURE 9: Projected senior AWO losses per year

Years of active Federal Service	Fiscal Year 83	84	85	86	87	88	89
19-20	54	48	90	94	148	163	114
20-21	33	29	23	44	46	73	80
21-22	13	14	10	9	18	19	29
22-23	15	10	11	11	10	19	20
23-24	13	12	2	2	2	2	3
24-25	7	7	6	5	5	5	4
25-26	6	8	8	7	5	6	6
26-27	4	4	9	9	8	6	7
27-28	2	2	5	6	6	5	4
28-29	0	0	5	5	6	6	5
29-30	4	8	12	10	9	10	10
30-R	10	7	14	7	7	6	7
Total	161	149	195	209	270	320	289

Note: The projected losses are based on an actual FY 1982 loss rate of 24 percent for AWOs past 20 years AFS.
Source: Professional Development Branch, Warrant Officer Division, MILPERCEN, December 1982.

Current AWO Retention Actions

Personnel Management Feedback System. The financial loss shown in figure 8 and the projected loss of experienced aviators indicate that, despite the recent increase in retention, the Army needs to continue its AWO retention effort. As a part of the Army's ongoing effort to improve retention of AWOs, ARI currently is developing a separation questionnaire designed specifically for AWOs. ARI was tasked by MILPERCEN to develop the questionnaire as a follow-on to the retention survey. A peliminary version of the separation questionnaire has been developed and is being field tested.

When the separation questionnaire becomes operational, it will be administered to all separating AWOs as a part of their general outprocessing from the Army. Information provided by the questionnaire can be used to establish a system that yields continuous feedback about AWO attrition. The system can provide current information about the number and types of AWO losses to the Army and about the factors that influence AWOs to leave the Army. Information about AWO losses can be used to determine aviator replacement needs, assess training requirements and forecast the AWO force strength. Information about attrition factors can be used to help personnel managers and decisionmakers monitor the effect of specific policies and events on AWO retention.

Leadership Changes. The top 10 factors identified by AWO attritees who participated in the ARI survey (figure 2) represent three major issues: pay and benefits (factors 1, 3, 4 and 9); assignment and career management (factors 7 and 10); and commissioned officer leadership and supervision (factors 2, 5, 6 and 8). The resulting DA/MILPERCEN initiatives (figure 3) produced actions that addressed primarily the issues of: a) pay and benefits, and b) assignment and career management. The commissioned officer leadership issues, which require long-term DA actions to effect changes, were not directly addressed by the initial series of actions.

The leadership factors that were identified as major contributors to attrition reflected the AWOs' perceptions that commissioned officer aviators lacked the competence necessary to be good leaders and decisionmakers in aviation matters. In addition, the commissioned officer aviators were preceived as lacking professional respect for the AWOs' experience and technical knowledge in aviation.

An Army Aviation Branch, designated this month by the Army, include changes that will have far-reaching effects on commissioned officer leadership. The Aviation

FIGURE 10: Projected authorizations for AWOs

Fiscal Year	Number of AWOs
83	5,885
84	5,915
85	6,272
86	6,276
87	6,264
88	6,355

Source: Adjusted PERSACS as of December 1982

Branch will enable commissioned officers to receive formal training in combined arms leadership at an aviation school. This training will produce commissioned officers who, as full-fledged members of the combined arms team, are highly skilled in the technical aspects and the command responsibilities of aviation.

Aviation Training. In addition to the Aviation Branch, changes in the IERW training program are being developed that affect leadership. POIs are being developed by DTD personnel at the Aviation Center that will provide aviation leadership training for commissioned and warrant officers in IERW. A similar program will provide more comprehensive training in "additional duty" requirements, including management responsibilities. The enriched training program should produce more effective aviation leaders among both commissioned and warrant officer ranks.

Although the retention rate for AWOs has significantly increased, the need for further improvement in AWO retention is clearly evident. At the current rate of retention, the Army is retaining only 6 out of 10 AWOs that it trains each year. By increasing its training rate to retain a larger number of AWOs, the Army is paying a heavy price for meeting its force structure requirements.

In order to reduce training rate costs and still meet its requirements, the Army must find a way to maximize retention of high-quality aviators. An immediate step in meeting this objective is a determination of the optimal number of AWOs that must be retained in order to meet the Army's projected AWO requirements at a minimum training rate.

Setting an optimal retention goal would be facilitated by analyses of both the performance level of AWOs who typically leave the Army and the costs of retaining these AWOs. A performance analysis would identify the types of AWOs who leave the Army—i.e., good performers or marginal performers. Information about performance is necessary to determine the impact that AWO attrition has on Army Aviation's effectiveness, since that impact is largely determined by the performance of those AWOs who leave.

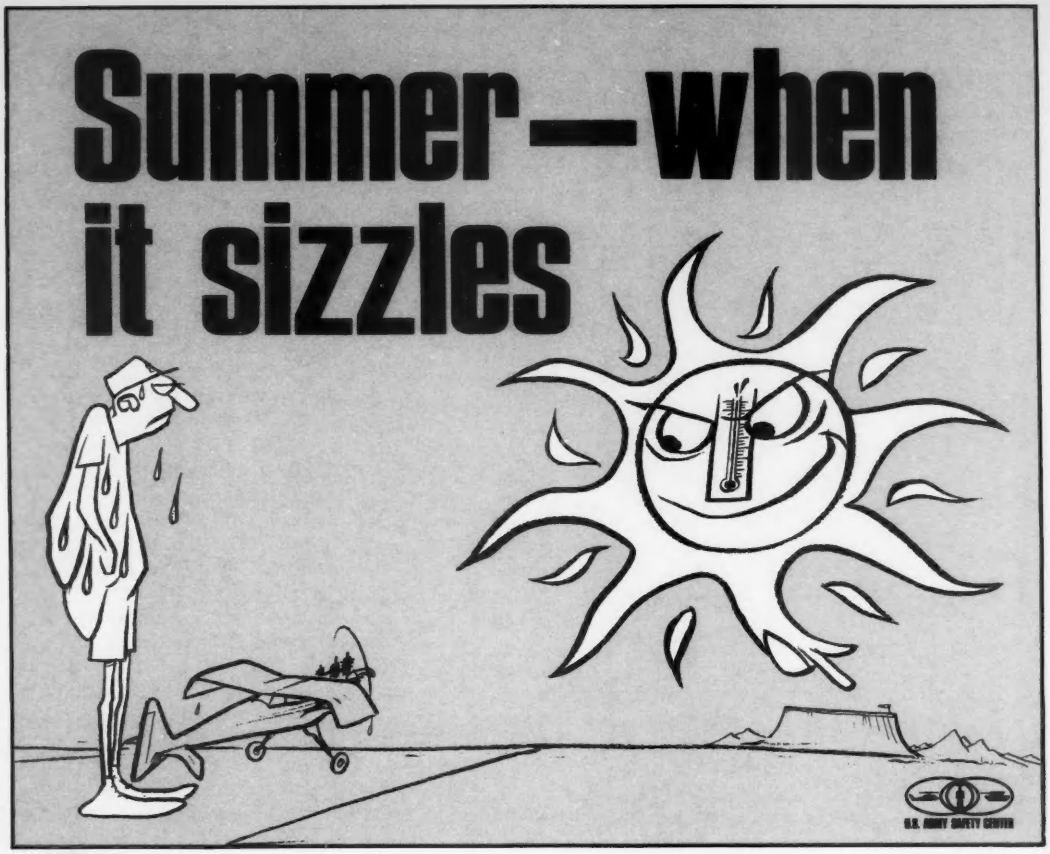
While AWO attrition has traditionally been viewed solely in terms of its negative consequences, it is possible that certain benefits may be derived from the loss of some AWOs—i.e., marginal performers. A cost-effectiveness analysis would permit an assessment of both the costs and benefits associated with AWO attrition. In addition, the analysis would facilitate the establishment of a retention goal that is realistic in terms of the costs associated with the actions required to prevent attrition. A cost-effectiveness analysis would help achieve this objective by identifying the conditions under which it may be more cost effective to accept attrition than to prevent it.

Based on the information presented here, it seems clear that a retention program is needed that considers both the Army's requirements and the most economical means of meeting these requirements. ARI previously has recommended that a retention team be established to spearhead the AWO retention program. The retention team would be the primary agency for implementing, coordinating and monitoring the Army's *continuing effort* to improve retention of AWOs.

[1] Beginning with FY 1977, the fiscal year was changed from 1 July through 30 June to 1 October through 30 September. FY 1977T represents the period 1 July 1976 through 30 September 1976 during which the transition to the new fiscal year concept occurred.

[2] The initial obligation was changed from 3 to 4 years effective 1 October 1978.

Summer—when it sizzles



ONLY A FEW short weeks ago you were concerned about the effects of cold weather, ice and blowing snow on your people and machines. Now it's already time to get ready for summer problems. Flying will be complicated by thunderstorms and high density altitude, while blowing sand and dust will ad ! to your maintenance woes. Extreme heat affects machines and they don't function as well, but the effects of heat stress on human machines are worse. Machines can break down—people can die.

When the air temperature combines with reflected heat from paving and other surfaces, ground temperatures can soar. High humidity adds to the discomfort and lowers exhaustion thresholds. The body attempts to cope with excessive heat by conduction-convection, radiation and evaporation. When surrounding air temperature is below body temperature and the air moves, through body motion or wind, you are cooled by the process of conduction-convection. However, when surrounding air temperature exceeds that of your body, you gain heat and become even hotter! If surface temperatures of surrounding objects are below body temperature, you lose heat by radiation; but when surface temperatures exceed body temperature, again you gain heat and become hotter still!!

Sweating is the body's most effective mechanism for cooling and maintaining proper temperature; but in order to cool, sweat must evaporate. Sweat dripping from your body on a sticky, humid day with little air movement won't cool you.

When your body tries to cool itself by vasodilatation in the skin, your heart rate increases as blood circulates from the center of the body to the skin. These adjustments place a strain on the circulatory system and play an important role in the production of heat illnesses. The effects can be even more critical if you are in poor physical condition, overweight, and maybe not so young any more.

According to the National Weather Service, an air temperature of 95 degrees F.,

combined with 80 percent humidity equals 136 degrees of "apparent temperature." When the apparent temperature exceeds 130 degrees, heatstroke or sunstroke may occur. Before such extreme conditions become imminent, there are some things that should be done.

• Acclimatize. A 10- to 14-day period of acclimatization is extremely important for people moving from a cool climate to a high temperature area. Physical conditioning must be done gradually and work should be scheduled to allow alternate periods of work and rest. Training should include cardiovascular endurance activities; e.g., running in place, rather than muscle work such as pushups. Even after people become acclimatized to a high temperature environment, there are circumstances which will cause them to have to repeat the process. For example: a leave spent in a cool climate, a period of hospitalization, or only two weeks of working in an air-conditioned building will require them to become acclimatized again when exposed to conditions which can result in heat stress.

Sufficient rest is important during the acclimatization period and abstinence from alcohol is recommended. After a winter hiatus from physical activity, individuals should be cautious about leaping suddenly into strenuous summer sports.

• Avoid dehydration. As little as a 1- to 5-percent water loss can result in discomfort and reduced efficiency, and you can lose up to 2.5 liters of water in an hour of strenuous activity on a hot day. Your body will need fluids long before you actually feel thirsty. The best policy is to drink liquids on a scheduled basis. Making a habit of drinking from every water fountain you pass by will help. (Some Middle Eastern countries require aircrews to drink 3 gallons of water a day!) Coffee and other drinks containing caffeine should be avoided because they tend to further dehydrate you. If plain water doesn't appeal to you, stick to fruit flavored drinks.

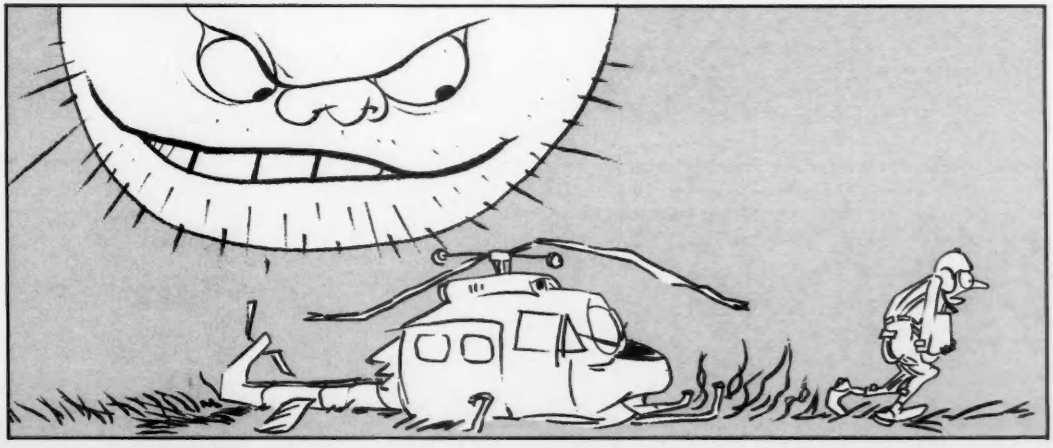
As you lose water by sweating, you will also lose salt. Normally, you will get enough salt in your food to replace any losses; but in times of extremely high heat and humidity, you may need to add a little salt to your normal diet. DON'T take supplemental salt without consulting a flight surgeon!

If adequate water and sufficient salt are not provided to balance losses, any of the following heat illnesses can result:

Heat cramps caused by loss of salt through excessive sweating can include severe stomach, leg or arm cramps; pale wet skin; dizziness and extreme thirst. The victim should be taken to a cool, shady place and, if conscious, given a glass of .1 percent saline solution (¼ teaspoon of table salt in 1 quart of water).

Heat exhaustion is caused by loss of water and salt through profuse sweating. Symptoms are the same as for heat cramps, plus headache and weakness. The victim may appear to be drunk, dizzy or drowsy and the skin is pale, cold, moist and clammy. The person may faint. Lay the victim flat in a cool, shady spot; elevate feet and loosen clothing. If the victim is conscious, give .1 percent saline solution slowly. Get medical help!

Heatstroke results from prolonged exposure to high temperatures and is more likely to strike a person who is not acclimatized to heat. Previous heat injuries make a person more subject to future attacks. If the victim stops sweating, the skin feels hot and dry, and the victim collapses and remains unconscious,



you have a true medical emergency. About 25 percent of the victims of heatstroke die! Temperatures in heatstroke victims sometimes reach 106 degrees to 110 degrees F. Pupils of the eyes are wide open, and there may be muscular twitching. If possible, immerse the victim in cool water while waiting for an ambulance. If you are unable to immerse the victim in water, soak his clothing or wrap him in a wet sheet while fanning to hasten evaporation. DO NOT try to give water to an unconscious person. Get medical help, fast!

• Prevent burns. Ultraviolet radiation from the sun on unprotected skin can produce painful and dangerous burns. The effects of sun will be intensified by reflection on bright surfaces. Exposure should be limited to no more than 5 minutes a day at the beginning of summer and care should always be taken not to overexpose the body to the sun's rays. While clothing reduces exposure of the body surface to solar radiation, it also decreases air movement over the skin. Clothing should be loose fitting, especially at the neck, wrists and lower legs, to allow for circulation of air.

Painful burns can also result from touching surfaces which have been exposed to the sun. When air temperature is 96 degrees F., an olive-drab painted aircraft can register 136 degrees and a shoulder harness buckle on a parked aircraft can be 150 degrees. (In the desert, surfaces can hit 180 degrees and beyond.) Ground crews should be cautioned about picking up tools, which have been lying in the sun, with ungloved hands. Mats and pads should be used to protect the body while working on surfaces that have been exposed to the sun's rays.

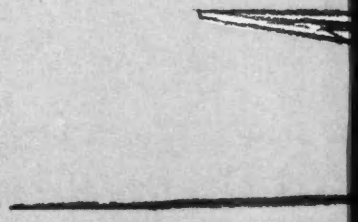
• Adjust work schedules. Whenever possible, schedule maintenance work for the cooler morning or evening hours. Appendix A, TB Med 507, "Prevention, Treatment and Control of Heat Injury," describes how the Wet Bulb Globe Temperature (WBGT) index is computed. The index will tell you when outside activities should be suspended, but your own knowledge of your crew's physical condition, age, state of acclimatization and other factors will help you decide when to schedule physically demanding activities.

Take advantage of any available shade to protect your people from the sun's direct rays. Camouflage nets or tarps can be used to create shade where there is none.

As a rule, aviators aren't affected as much as ground crews by extreme heat because of their limited physical activity and the somewhat cooler temperatures at higher altitudes. (You may have a little difficulty convincing aircrews that they have it better while they are involved in preflight activities.) Most of the high temperature stress they encounter is prior to takeoff when the heat-soaked aircraft, reduced

PROTECT YOUR MACHINES

- Cover aircraft whenever possible with canvas or matting. Leave canopies partly open (except during dust or rainstorms) to prevent excessive heat buildup.
- Avoid hovering in helicopters, or reversing engines in fixed wing aircraft to prevent damage from blowing sand and dust to other aircraft.
- While aircraft are parked, use covers and dust excluder plugs on all engine openings, vents, air intakes, exhaust outlets, breathers, over propeller hubs and feathering domes, cowls and over all other vital components and openings, including pitot and static ports.
- Whenever possible, transfer fuel directly from the original containers to tanks to avoid picking up dirt.
- Inspect your aircraft thoroughly and frequently. Clean or replace filters at regular intervals. Check flight controls for freedom of movement and control cables for specified tension.
- Clean aircraft and engines as needed with water and appropriate cleaning fluids. DO NOT use gasoline, steam, or a high pressure water hose to clean helicopters.
- Use your maintenance publications. If you run into a special problem, don't guess, check with the supervisor.



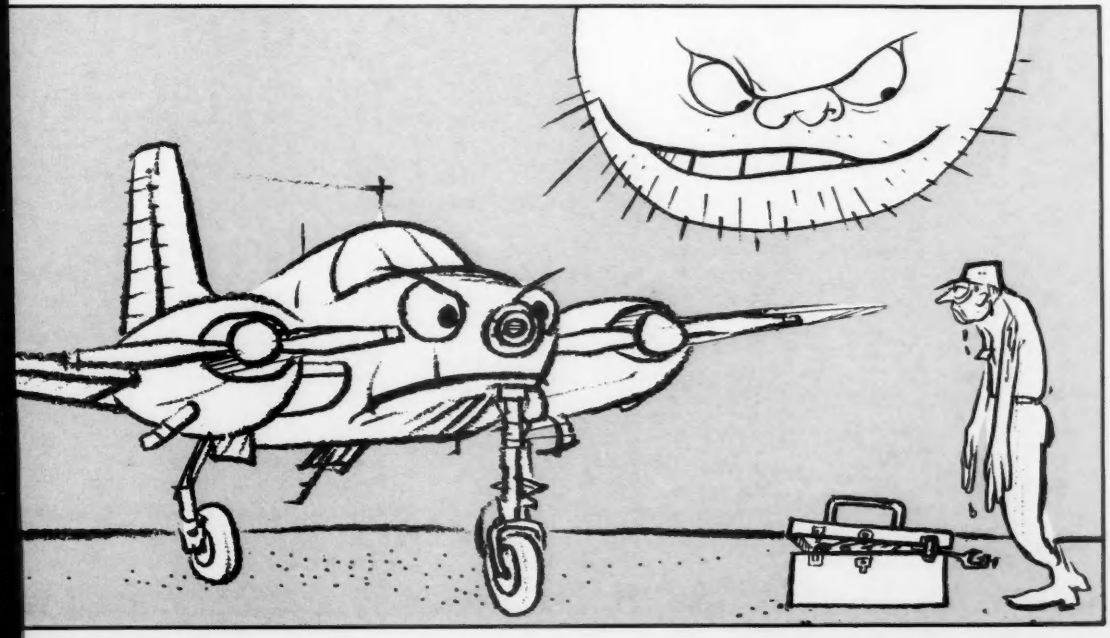
air movement in the confined cockpit space and the flying equipment they must wear contribute to a high heat load. It takes 15 or 20 minutes at the cooler temperatures aloft just to dissipate the heat they have accumulated on the ground. If crews are flying prolonged low-level missions where the flight level ambient temperature is high, their tolerance limits should be closely calculated and monitored by the flight surgeon and flying supervisors.

Psychomotor changes caused by extreme temperatures can affect pilot performance, particularly in association with new or emergency situations. In "How Weather Can Affect the Way You Feel and the Way You Fly," *MAC Flyer,* August 1981, Captain R. M. Lloyd states:

> As body temperature rises, crewmember skills are affected, especially complicated tasks. At 103 degrees F. man's ability to perform complex tasks is hampered by twice the number of errors compared with performance at 98.6 degrees F., the body's normal temperature. Interestingly, as people get hot they tend to perform more rapidly, but they make more mistakes. Short term memory can be affected by heat stress which can make it more difficult to copy down instructions correctly. Judgment can be impaired, as the case of one unfortunate B-52 crew illustrates:
>
> The bomber developed a fault in its heating system which went bananas and tried to roast the crew. The aircraft commander even undressed down to his undershorts. They bypassed three perfectly good airfields before finally becoming totally incapacitated and crashing. All souls on board were killed with the exception of the tail gunner who had his own heating system which was unaffected—he bailed out.

At the same time that extreme heat adds to your maintenance and flying problems; it subtracts from your people's ability to cope. Their strength and energy are sapped just at the time that demands are greatest. Reactions are slower, tempers are shorter and mistakes are more likely. The loss of a war for want of a horseshoe nail can have its modern parallel in undetected malfunctions, replacement of wrong parts or improper repairs. Pilot error can increase and aircraft and lives may be lost.

Forewarned is still forearmed. The sooner you anticipate problems associated with extreme heat and humidity and begin getting ready for them, the less effect they will have on you and your crews. Summer is a time for recreation and fun—we want you to stay around to enjoy it.



"Hangar Talk" is a quiz containing questions based on publications applicable to Army Aviation. The answers are at the bottom of the page. If you did not do well, perhaps you should get out the publication and look it over.

AR 95-1

Army Aviation: General Provisions and Flight Regulations

CW2 (P) Gary R. Weiland
Directorate of Training Developments
U.S. Army Aviation Center
Fort Rucker, AL

1. Flying time begins when an aircraft's engines are started for the purpose of flight.
a. True b. False

2. Smoking is permitted in Army aircraft during low level flight.
a. True b. False

3. Aviation unit standing operating procedures must include a crew rest program.
a. True b. False

4. Passengers will not be carried in an aircraft with chemicals onboard.
a. True b. False

5. "Pilot in command" is a crew duty assignment.
a. True b. False

6. Aviators flying helicopters may reduce visibility minimums for approaches labeled "COPTER ONLY" by 50 percent, but not less than ¼ mile or metric equivalent.
a. True b. False

7. Dual very high frequency omnidirectional range (VOR) equipment requirements specified on approach charts apply to Army aircraft.
a. True b. False

8. Dual VOR approach minimums specified on approach charts apply to Army aircraft.
a. True b. False

9. An operable landing or searchlight is required for day flight.
a. True b. False

10. A maneuver such as a "break" is considered to be an aerobatic maneuver even when conducted in conformance with the aircraft flight manual.
a. True b. False

ANSWERS (AR 95-1)

1. b, para 1-20
2. b, para 2-10
3. a, para 2-12
4. a, para 2-18
5. b, para 3-21
6. b, para 4-2
7. b, para 4-5
8. a, para 4-5
9. b, table 4-2
10. b, glossary 2

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APRIL	Reporting Final: WO Occupational Survey, Test Pilots Selected, ACC Stabilized Tours	PEARL'S: The Art Of Survival, SPH-4—The Incredible Shrinking Helmet, Radio Pocket Shortage, SPH-4 Visor Track Problem, New Direction On Lensatic Compasses, Obsolete Seat Belts	The Attack Helicopter School And Center Of The Future 1981 U.S. Army Aviation Training Symposium/ Policy Committee Meeting Tower Talk: Aviation Weather, FM 1-30 ATC Action Line: The Third Ingredient—Oral Communications ACTAAT: HITMORE Vs. GACP	Regarding Rotors DES: FY 1981 Class A Mishaps Confidence Vs. Competence—When To Eject From The OV-1 Who's In Error? (p. 37) Christmas Captions	How Long Can we Fight?—Proposed Reorganization Of Current Attack Helicopter Units Army Aviation Mission Area Analysis	16th ATC Battalion In The Field—Golden Saber V Deepwoods—Maine National Guard Crisis Threat: Warning: The Threat Branch Has Determined That Soviet ATGMs Could Be Hazardous To Your Health Heliborne Electronic Warfare System	40th Birthday—Calendar Of Events (Inside Back Cover) National Guard Unit Listings (Back Cover)	APRIL
MAY	Aviation Update—The Army Aviation Engineering/Flight Testing Selection Board Selected Four Primary and Four Alternate Pilots For Its Program, Aviation Warrant Officers' Openings By MOS Aviation Personnel Notes: Special Duty And The Aviator, Key Personnel Changes The Aviation NCO	Aviation Update—AH-64, UH-60, AH-1S, Army Helicopter Improvement Program, Wire Strike Protection System PEARL'S: New SPH-4 Earphone, Camouflage For Flying Helmet, Supply Catalog Problems Yellow Is Better Hangar Talk: TC-1-62 And TM 10-8415-206-13	DES: Observation Performance Planning Card Hangar Talk: TC-1-62 and TM 10-8415-206-13 ACTAAT: Landing Update	Aviation Update—Aircraft Accidents Super Safety Training Weekend—Or Why Waste A Good Weekend Of Flying With Classes Regional Accident Prevention Survey Program (ARNG) From Routine To Near Disaster		Putting The Air Assault In The Air Assault Division Threat: Soviet Air Defenses Against Attack Helicopters—Part I, The Philosophy RSI Report ATC Action Line: IFR Takeoff Minimums And Departure Procedures	Life Support Equipment Insurance Corporation (Certificate) Reporting Final: Battlefield Term Classification ALSE Course VFR: Threat, AirLand Battle Training	MAY
JUNE	Aviation Personnel Notes: Upcoming Board Dates, Maintaining Aviation Force Structure Documents	PEARL'S: Compass Problems—MC-1; New ALSE Training Films; Water Purification Tablet, Iodine; Operational Hazard Report; SPH-4 Loose Grommet Condition	Aviator Selection Research, Then And Now—FAST And RFAST DES: Employment Of Army Aviation: Filling The Void	ATC Action Line: The National Airspace System Plan (NASP)—Improving Air Traffic Control	Army Aviation Systems Program Review '82—Overview	Flight To Arizpe—Army Aviation's Reputation As A Good Neighbor To Civilian Communities Threat: Soviet Air Defense Against Attack Helicopters, Part 2: Individual Weapons ACTAAT: IMC For Cobra	Forty Years Of Army Aviation, Part I: Grasshoppers 40th Birthday Roundup (p. 1) A Detailed History Of The U-21 Army Aviation—Age Forty (prose)	JUNE
JULY	Aviation Personnel Notes: Chemical Corps Moves To Strengthen Officer Inventory, Your DA Photo Is Important, Specialty Code 28-Elimination, Retirement In Lieu Of PCS, Sequencing Of Specialties On Your ORB	PEARL'S: Headbands For Spectacles; AR 95-XXXX-Army Aviation Life Support System Program; AN/PRC-90 Survival Radio; Survival Radio Test Equipment—TS-24B; Report of Discrepancy (ROD); Aircrew Personnel	DES: Aviation Center's Branch Training Team: ACTAAT—Linking Field Units, Service Schools And Training Centers Forty Years Of Army Aviation, Part 2: Building A Training Program	When Will We Learn About Mountain Flying?	Army Aviation Systems Program Review '82: Concepts, Doctrine And Tactics CBAA Testing Period Finished—9th Cavalry Brigade (Air Attack)	Victory In Air-to-Air Combat, The Marine Corps Way	Reporting Final: Perfect Student Makes WO Senior Course Listing Of Army National Guard Units Annual Writing Award Winners	JULY

	Personnel and Career	Materiel	Training and Training Developments	Accident Prevention and Safety	Organization	Operations	Miscellaneous	
JULY	quencing Of Specialties On Your ORB Reporting Final: New Warrant Officer MOS	Report of Discrepancy (ROD); Aircrew Personnel Body Armor, Small Arms Protection; Survival Vest, Radio Pocket—Stock Exhausted; Survival Vest, SRU-21/P	tion, Part 2: Building A Training Program ATC Action Line: The Go-Around—Lifesaver Or Killer? Tower Talk: FAAH—Landing And Takeoff ACTAAT: Drill Distance (SFTS) ACTAAT: NVG Qualification		Brigade (Air Attack)		Annual Writing Award Winners	JULY
AUGUST	Army Aviation Medal Of Honor Awardees (p. 29)	PEARL'S: Exception Requisition—AN/PRC-90 Survival Radio, TC 1-62 and FM 1-302, SPH-4-AQUA-AIRE DLA 100-80-C-2226 Defective Helmets, Oxygen Throw-Away Masks Maintenance/Inspection, Lensatic Compass—NSN 6605-00-151-5337YS Radioactive, Nomex Thread, Seat Belts-Obsolete Changes, 2.75 Inch Rocket System Upgrade ACTAAT: Equipment Requirements	ALSE School Opens At Ft. Eustis (Outside Back Cover)	DES: Dynamic Rollover Accidents		Helicopter Aerial Combat Week—14-18 December 1981 Forty Years Of Army Aviation, Part 3: Combat ATC Action Line: Noise Abatement Threat: Soviet Air Defenses Against Attack Helicopters—Part III: ZSU-23-4 Shilka		AUGUST
SEPTEMBER	Aviation Personnel Notes: Command Selections, Key Personnel Changes, Special MILPERCEN Selection Board, Drug And Alcohol Abuse By Aviators	PEARL'S: A New Look To AR 40-61 Is Coming, Requisitioning Of Medical Materiel, Update On First Aid Kit Inspection, Pistol Holster For SRU-21/P Vest, AN/MQ-1A Oxygen Tester, Water Purification Tablets, Water Purification Tablet Serviceability Testing, Hand-Generated Flashlights Being Evaluated, Unsuitable Earplugs, Protection From Riot Control Grenades, SPH-4 Spares For MK-896A Headset Microphone	Knights Train For The Night—Latin America Series Hangar Talk: TM 55-1500-328-25 A Lieutenant's Guide To The Aviation Warrant Officer	Rotor-Induced Whiteout DES: U.S. Army Aviation Standardization Program Pilot Error, Human Error	Army Aviation Systems Program Review '82—Organization And Force Structure Panel	Army Aviation In Latin America—Introduction Battle Line The Sky—Operations and Conditions In Panama CH-47 Operations In Central And South America Maintenance, Latin American Style Forty Years Of Army Aviation, Part 4: Armed Helicopters ATC Action Line: Lost Communications: Filing Fact Or Fiction RSI Report—STANAG 3532 Transport Of Troops By Helicopter	Vanderpool's Fools Listed (p. 32) Hotline (p. 43) Reporting Final: Daedalion Award, FM 1-230 "Meteorology For Army Aviators" To Be Printed, Original Colored Drawing Of 1st Brigade Crest Now At Ft. Rucker	SEPTEMBER

	Personnel and Career	Materiel	Training and Training Developments	Accident Prevention and Safety	Organization	Operations	Miscellaneous	
OCTOBER	Aviation Personnel Notes: CMF 67 Update Reporting Final: Test Pilot Selection	Army Aviation Systems Program Review '82—The Materiel Panel, Aviation Materiel Systems PEARL'S: Water Purification Iodine Tablet, Aviators' Breathing Oxygen, Fitting Of Protective Masks, Compass Problems, Fishing Kit Preparing For Winter USAAEFA Tests Help to Ensure Readiness	Army Aviation Systems Program Review '82—The Training Panel, AirLand Battle Studied Tactical Air Traffic Control Training—Not A Blind Approach Tower Talk: FAAH 7110.65c ACTAAT: Laser Hazards	ATC: Action Line: Parachutist Vs. Aircraft ACTAAT: Lazer Hazards	Forty Years Of Army Aviation, Part 5: Policies And Organizations	NBC Survival—A Matter Of Attitude DES: Mission Planning For Night Flight Operations Army Aviation In Latin America—Where's The Foreign Clearance Guide?	How To Get The *Digest* (p. 18) Listing Of Directors Of Army Aviation And Army Aviation Officers (p. 31) Reporting Final: Museum News	OCTOBER
NOVEMBER	Aviation Personnel Notes: New Army Engineering Test Pilots, Command And Staff College Selection Procedures	PEARL'S: SPH-4 Ear Seals, TACOM Technical Area Manager For Life Support, Life Preservers, New Life Raft Cobra Survival Kit	More Flight Hours/Less Fuel Dollars—Framework For An Army Fuel Conservation Program Hangar Talk: FM 1-5, Instrument Flying And Navigation For Army Aviators Reporting Final: New Publications, FM 1-301 Aeromedical Training For Flight Personnel, FM 1-202 Environmental Flight; Third Annual Policy Committee Meeting/Training Symposium	Professinalism And The FY 82 Aircraft Accident Record DES: Stress = Reduced Vigilance = Accidents ATC Action Line: More On The Near Midair Problem ACTAAT: Crew Rest		JAAT, A Present Concept Threat: How Do You Spell Threat? Dustoff Panama Noise Abatement And Flying Neighborly	Reader's Survey VFR: ARNG Listings—Missouri and Washington Reporting Final: Military History Chief Is Master Army Aviator	NOVEMBER
DECEMBER	Annual Writ—The Army Aviation Annual Written Examination ACTAAT: WO1 IP? Aviation Personnel Notes: Project Manager Development Program, Five-year Promotion Plan ACTAAT: National Guard ATC Quotas	LHX: The Conceptual Formulation of Why, What and When LHX: Keeping Pace With Technology Sweet Dreams And Flying Machines PEARL'S: Magnesium Batteries, Aviator Sunglasses, Safety Ties, Fire Extinguishers	DES: Standardization Flight Evaluation Results, FY 82	The Harsh Lessons Of FY 82 Who Needs It Anyway?—Proper Wear And Use Of Safety Equipment OH-58 Power Droop ATC Action Line: "But I did Check NOTAMs!"		LHX In The AirLand Battle 2000 RSI—Procedures For Downed Helicopters	1982 ATC Awards Reporting Final: *Aviation Digest* Annual Writing Award Winner	DECEMBER

REPORTING FINAL

Late News From Army Aviation Activities

UNIT REPORTS

Ft. Rucker, AL—The U.S. Army Aviation Board (USAAVNBD), Ft. Rucker, is preparing for the Light Air Cavalry Troop Test scheduled to commence this spring at Ft. Lewis, WA, as part of the 9th Infantry Division's High Technology Light Division testing program.

Thirteen OH-58s from Ft. Rucker are scheduled to take part in the various phases of testing. The helicopters, which have been modified with air transportability kits, permit their four-man crews to configure them for loading aboard C-130 or C-141B transports in about 7½ minutes as opposed to the more than 1½ hours previously required by a crew of six. Similarly, a crew of four can offload a modified OH-58 surrogate or light combat helicopter (LCH), reconfigure it for flight and arm it for the type of mission it is to perform in about 20 minutes. This is less than one-fifth the time previously needed by a crew of six. Further, no wrecker or crane support is needed to ready the modified helicopter for airlift or to reconfigure it for flight. Use of the air transportability kit also permits two OH-58s or two LCHs to be airlifted in a C-130 instead of only one. Six can be transported in a C-141B. Development of the air transportability kit was spurred by the need for the Army to have the capability to rapidly deploy combat ready troops and equipment strategically and tactically to any part of the world and then quickly assemble them into an effective fighting force.

Loading Up. OH-58s are equipped with air transportability kits. These helicopters will participate in the Light Air Cavalry Troop Test this spring at Ft. Lewis, WA

Evaluation of the Army's ability to meet the rapid deployment criteria will be of major concern during the forthcoming test. Training of helicopter crews was conducted on 12 and 13 February 1983 at Cairns Army Airfield by Aviation Board personnel in conjunction with Air Force C-130 crewmembers. Among those on hand to observe the training were BG Charles E. Teeter, deputy commanding general, U.S. Army Aviation Center, and COL Robert A. Wagg, Jr., President, U.S. Army Aviation Board.

photo by SSG Cindi Small

Airmobile Attack. Republic of Korea soldiers scurry from one of 18 UH-1 Hueys used during a recent training exercise in which the 52d Aviation Battalion worked with the ROK troops for a combined effort of troop mobility

Seoul (EUSA)—Two armies joined forces recently in a training exercise which supported the effectiveness of combined efforts to maintain peace on the Korean peninsula.

The U.S. Army's 52d Aviation Battalion used its aircraft to transport more than 400 Republic of Korea (ROK) Army troops, using a maneuver designed to provide more efficient troop mobility.

According to MAJ George H. Artola, operations officer for the 52d, the uniqueness of this exercise was the use of multiple routes and multiple landing zones (LZs). "We moved a battalion of ROK soldiers about 20 kilometers from a pickup

zone (PZ) near Uijongbu, to multiple LZs in support of an air tactical scenario where the ROKs were to secure a bridge.

"We tried something different that we hadn't done in a while", MAJ Artola explained. "Instead of flying basically one route with all the choppers in sequence and landing in the same area, we had three groups of six aircraft each leave the PZ flying separate routes to three different LZs. This meant we had a total of 18 aircraft flying and landing troops in three different areas all at the same time, putting the maximum number of troops on the ground at once.

"Each chopper in the lift was loaded with ROK soldiers. The aircraft flew to the multiple LZs, all in the vicinity of the bridge, dropped off the troops to conduct their ground operations in that area and returned to pick up the next increment of troops. This was done three times, using UH-1 Hueys and CH-47 Chinooks, to get the full ROK battalion transported.

"By using multiple routes, we reduce the number of aircraft exposed to the antiaircraft threat in any particular area," MAJ Artola explained. "Multiple routes going into multiple landing zones break up the capability of enemy air defense to concentrate on any one particular flight corridor." **(SSG Cindi Small)**

Ft. Campbell, KY—The U.S. Army's 101st Airborne Division (Air Assault), Ft. Campbell, KY, recorded another illustrious first on 28 February 1983 when its 159th Aviation Battalion became the first Army helicopter operational unit to take delivery of a newly modernized Boeing CH-47D Chinook. Delivery—from the Army's Aviation Research and Development Command (AVRADCOM), St. Louis, Mo—took place in ceremonies at Campbell Army Airfield. The CH-47D is the first of several that will be delivered to the 159th during the next year.

Ft. Wainwright, AK—Air traffic controllers of the 7th Signal Command are reaching out to modern technology for help in the battle against the problems peculiar to the arctic soldier.

Four members of the 2d Platoon, 57th ATC Company (FWD), recently were trained in the use of night vision goggles. It is the first and only unit in Alaska so trained.

Previously, the feasibility of using the goggles in Alaska was questionable because of the highly reflective qualities of the snow. The goggles should only be used in minimal light. Artificial, daylight or even bright moonlight can cause the goggles gain control to close down, temporarily interferring with the wearer's vision. The tower controllers qualified in the use of the goggles will deploy with the 222d Aviation Battalion to Ft. Greely to test them in the field. They will run a control tower in a remote location under no-light conditions.

Ft. Ritchie, MD—When a civilian aircraft crashed and burned near Ft. Campbell, KY, recently, it was a 7th Signal Command air traffic controller that was instrumental in saving the life of the downed pilot.

SFC Eddy O. Carter, assigned to 7th Signal Command's unit at Ft. Campbell, has been nominated for an award under the Air Traffic Control SAVES Program for his performance while coordinating the rescue efforts.

SFC Carter was working the arrival/departure position at the Campbell Army Radar Approach Control (ARAC) Facility when the emergency occurred. The Campbell ARAC tapes indicated that he remained very calm and reassuring throughout the emergency.

The pilot of the aircraft said that the professionalism and efficiency demonstrated by the controller made him confident that even if he did crash and was injured, he would be resuced immediatley.

SFC Carter was advised by Memphis Center that a Cessna 172 en route from Outlaw Field, Clarksville, TN, to Memphis had developed engine problems and was returning to Outlaw Field.

SFC Carter immediately had the Campbell Army Airfield crash alarm system activated and requested medical evacuation (medevac) helicopter assistance. He advised the pilot that medevac was on the way and asked for a description of the area where the plane was going down.

Marking the point where radar contact was lost with the aircraft, SFC Carter contacted the Sabre Army Heliport control tower, the facility closest to the downed airplane, and asked for help from any airborne aircraft to locate the crash site.

Two Army aviators, 1LT James Brockway and CW2 Stanley McGowlen, were flying an OH-58 Kiowa in the vicinity and agreed to help in the search.

The pilots saw smoke coming from a wooded area 2 miles before reaching the site. Upon reaching the site, the pilots reported seeing the downed aircraft and that it was on fire.

After finding a landing area about 300 meters from the wreckage, CW2 McGowlen ran to the crash site with a first-aid kit and fire extinguisher.

He found the pilot of the downed aircraft lying unconscious about 15 feet from the burning plane. Just as he reached the pilot, the plane's right fuel tank burst into flames. As he was checking the pilot's vital signs, the plane's other fuel tank exploded, scattering burning debris all around him and the injured pilot.

The officer removed the debris and put out the fire. The medevac helicopter, called by SFC Carter, then arrived at the scene. The crew evacuated the injured pilot to Campbell Army Hospital where he was treated for minor injuries.

SFC Carter's quick thinking and sound judgment had the OH-58 helicopter at the crash site within 9 minutes and the medevac helicopter at the site within 15 minutes. **(Ellen A. Britsch)**

Rankin AAF Gets C-12 Huron. It may have been assigned to Saudi Arabia for the past 4 years, but now it's on Japanese soil. The new addition is a C-12 which will be used to support the U.S. Army Japan/IX Corps mission at Camp Zama's Rankin Army Air Field. The plane landed at Atsugi Naval Air Facility after an extensive worldwide journey.

This extensive travel took the aircraft and crewmembers through a variety of cities and countries including France, Italy, Greece, Saudi Arabia, India, Thailand, Philippines and Okinawa.

Rankin Army Airfield now has its own plane to help in its assigned support mission. Even though the C-12 is housed at Atsugi, because of certain landing conditions at Rankin, the aircraft will help Camp Zama in its responsiveness to fixed wing missions.

C-12 for Camp Zama

photo by SP4 Ely

Change of Command. Major General Carl H. McNair Jr., is being reassigned from his position as commander of the U.S. Army Aviation Center, Ft. Rucker, AL, to that of Deputy Chief of Staff for Combat Developments, U.S. Army Training and Doctrine Command, Ft. Monroe, VA. Brigadier General (P) Bobby J. Maddox will be the next commander at Ft. Rucker. He will be transferred sometime this summer from Ft. Campbell, KY, where he is assistant division commander, 101st Airborne Division (Air Assault). Meanwhile, Brigadier General Ellis D. Parker, Deputy Director of Requirements and the Army's Aviation officer with the office of the Deputy Chief of Staff for Operations and Plans, Washington, DC, will replace BG (P) Maddox with the 101st.

NEWS EVENTS

Washington, DC—The Helicopter Association International has established the International Helicopter Foundation, primarily to promote helicopter safety and education, and to collect and preserve data relating to the history and development of the helicopter. An important part of the new foundation is John "Slats" Slattery's Helicopter Archives, a collection of historical helicopter memorabilia dating back to the late 1920s. Other key elements of the foundation will be programs aimed at promoting and enhancing public knowledge of helicopter operations and technology, and stressing safety in all aspects of helicopter activities. For more information, contact:

Sarah Hammann
1110 Vermont Avenue, N.W.
Suite 430
Washington, DC 20005
Telephone: 202-466-2420 (Telex 89-615)

Lynn, MA—The first General Electric T700-GE-701 production engine has been delivered to the U.S. Army at ceremonies at the company's Lynn facility. Two T700-GE-701 turboshaft engines power the Army's new AH-64A Apache advanced attack helicopter.

The T700-GE-701 is an uprated version of the original T700-GE-700 engine developed to power the Army's Black Hawk helicopter. The Apache engine features 10 percent more power for normal operations than the original T700 and 20 percent more power for single-engine contingency operation in hot climates.

PEARL'S

Personal Equipment And Rescue/survival Lowdown

Brenda Sando photo by Reflections Studio

ALSE Training

The Aviation Life Support Equipment (ALSE) Course for enlisted personnel at the U.S. Army Transportation School, Ft. Eustis, VA, is completing its 16th class. The school has graduated one officers' class and the second class started on 27 March 1983. The third class for officers is planned for June 1983. Quotas for both the officer and enlisted courses may be secured through your unit training activity. Due to the high demand for quotas, it is imperative that your requirements be submitted at the earliest possible date.

Aviation Resource Management Surveys (ARMS)

The ARMS team now includes an ALSE representative. The last ARMS included Anniston Army Depot, Anniston, AL, and the Aviation Development and Test Activity, Ft. Rucker, AL. By the time you get this issue, they will have been to Ft. Huachuca, AZ; Yuma Proving Ground, Yuma, AZ; White Sands Missile Range, NM; and Sierra Army Depot, CA. We have found that these visits are beneficial to the units and they certainly highlight the level of ALSE training and in some cases identify ALSE support needed.

Body Armor, Small Arms Protective Aircrewman, Front Torso And Front/Back Torso

Assets of the assembled items in sizes short, national stock numbers (NSNs) 8470-00-935-3183/3192, and regular, NSNs 8470-00-935-3184/3193, are exhausted. Requisitions received for these NSNs will be rejected with status code "CK." Assets are available for size long only, NSN 8470-00-935-3185/3194. Army activities authorized subject body armor should requisition out-of-stock sizes by available components and assemble the item.

SIZE	VEST	FRONT PLATE	BACK PLATE
Short	8470-00-999-1473	8470-00-935-3177	8470-00-935-3174
Regular	8470-00-999-1474	8470-00-935-3178	8470-00-935-3175

NOTE: Specification for the assembled item, which was previously cancelled, has been reinstated and future procurement is planned. Army activities will be advised when assets of the assembled items are available in all sizes. Point of contact is Geraldine Lyles, Army Support Activity, AUTOVON 444-2537 or Mr. Ed Daughtery, DRCPO-ALSE, AUTOVON 693-3307.

SPH-4 Helmet, Flyer's

Cracked SPH-4 helmet (NSN 8415-00-144-4981 and NSN 8415-00-144-4985) shells are not authorized to be repaired in accordance with TM 10-8415-206-13 and will be disposed of through property disposal channels. If additional information on maintenance and repair is required, your point of contact is U.S. Army Troop Support and Aviation Materiel Readiness Command (TSARCOM), Directorate of Maintenance, ATTN: DRSTS-MCAPL, 4300 Goodfellow Blvd., St. Louis, MO 63120; Mr. Boone Hopkins at AUTOVON 693-3112/4 or commercial (314) 263-3112/4.

Jacket, Flyer's, Medium Weight (Nomex) And Jacket, CW, Aramid, OG-106

Jacket, flyer's, medium weight, LIN L14520, NSNs 8415-00-221-8870 and 8415-00-217-7387 (s), authorized to aviation personnel, is being phased out and is no longer being procured. Replacement item is jacket, cold weather (CW), Aramid, OG-106, NSN 8415-01-074-9413 (s), which is authorized for combat vehicle crewman (CVC) and aviators. However, requisitioning by CVC is *not* yet authorized.

The replaced item, jacket, flyer's, medium weight (Nomex), will be issued to Army flyers until stocks are exhausted. Aviators should continue requisitioning the replaced item in sizes with available assets. The replacement item jacket, CW, Aramid, OG-106, should be requisitioned on out-of-stock sizes only. Automatic substitution will not be made.

A list of Defense Personnel Support Center's (DPSC) (S9T) remaining assets by size is provided for the phase-out item. NSNs are also furnished for the replacement item. Size is applicable for both the phase-out and replacement item:

Jacket, Flyer's, Medium Weight (Phase-out Item)		Jacket, CW, Aramid (Replacement Item)	
Assets	NSN	Size	NSN
0	8415-00-221-8870	XS-SH	8415-01-074-9413
0	8873	XS-RG	9414
6	8874	XS-LG	9415
788	8879	S-SH	9416
1,936	8884	S-RG	9417
0	8886	S-LG	9418
436	8920	M-SH	9419
0	8415-00-217-7387	M-RG	9420
0	7391	M-LG	9421
11	7400	L-SH	9427
0	7401	L-RG	9422
360	7402	L-LG	9423
0	7422	XL-SH	9424
0	7423	XL-RG	9425
0	7424	XL-LG	9426

PEARL'S Questions And Answers

About 2 years ago I remember reading a very interesting article from the Louisiana Army National Guard pertaining to aviation life support equipment and the training that one sergeant received in one of the ALSE schools. I believe it was the Army National Guard ALSE Course which was conducted at the Army National Guard Training Center, Little Rock, AR.

You are absolutely right and the gentleman who wrote the article is MSG Bartholomew J. Dawson, Louisiana Army National Guard ALSE technician. He can be reached by writing to Headquarters, Louisiana Army and Air National Guard, Office of the Adjutant General, Army Aviation Support Facility, Building 101, Lakefront Airport, New Orleans, LA 70126. I have heard many good comments about that article and have been thinking of running the article again.

Another excellent article was titled "The Greatest Show on Earth" by CPT Lynn Lanzoni and was printed in the April 1981 *Digest.* In fact, many articles have been written on this fast growing area of ALSE, and I would certainly recommend their retention and review, especially for the new ALSE people we are getting in.

Additional Skill Identifier (ASI) Q2

Originally the military occupational specialty (MOS) 67 series was identified for the ASI Q2, but many of our aviation commanders have found that they can better send personnel with other MOSs to undergo the ALSE training. All enlisted students graduating from the Ft. Eustis ALSE Course 860-ASI Q2 are given certificates of graduation. These students' names are furnished to Headquarters, Training and Doctrine Command and Military Personnel Center (MILPERCEN) for the Q2 identification. As far back as November 1981, MILPERCEN has supported these actions. A MACRIT (TOE Manpower Authorization Standards and Criteria) is being developed by the Ft. Eustis group which will justify an ALSE career field. This will ensure that we can identify spaces specifically to ALSE on TOEs (tables of organization and equipment) and TDAs (tables of distribution and allowances) and will provide for more incentive to make a career MOS in this critical field. Commanders are continuing to send MOS 67 and other MOS personnel to the ALSE school, and we will continue to support this.

SPH-4 Ear Seals (Correction)

Reference is made to the November issue of the *Aviation Digest* and the PEARL article on the SPH-4 ear seal. This article was called into our office, and we find it should be disregarded as far as aircrew personnel are concerned. In fact, the mention of the SPH-4 is misleading as these are not nonhardening ear seals but are the old plastic type and are used on H140/U headset, NSN 5965-00-892-1010. The Defense Electronics Supply Center (DESC), Dayton, OH 45401 (RIC-S9E), can be reached on AUTOVON 986-6407 or commercial (513) 296-6407. By the way, the correct NSN for the SPH-4 nonhardening ear seal is 8415-01-111-9027. Should more information be desired, our point of contact is Mr. Tommy Vaughn, AUTOVON 693-2492/3307.

If you have a question about personal equipment or rescue/survival gear, write PEARL, DARCOM, ATTN: DRCPO-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120 or call AUTOVON 693-3307 or Commercial 314-263-3307

AVIATION PERSONNEL NOTES

Congratulations!

To those aviators selected by the January board for entry into the Army Aviation Engineering Test Pilot Program. As expected, competition among applicants was extremely keen. Those selected are truly "best qualified."

Captain Leo B. Cayton
Captain Jan S. Drabczuk
Captain Richard H. Langhorst
Captain John R. Martin
Captain Austin R. Omile
CW3 Thomas M. Valentine

Congratulations again and best of luck on a most demanding assignment.

The same to those Army aviators selected for Command and Staff College for academic year 1983/1984. The number selected precludes reproducing all of the names here, but a hearty "well done" to the 182 aviators selected.

Upcoming Policy Change

A revision of AR 600-105, "Aviation Service of Rated Army Officers" will empower the general court-martial convening authority to approve Flying Evaluation Board (FEB) proceedings.

Current policy states that an FEB will be convened when one or more of the following conditions exist:

- Lack of proficiency.
- Flagrant violation of flying regulations.
- Undesirable habits or traits of character.
- Insufficient motivation.
- Failure to complete graduate flight training.
- Failure to maintain medical certification.
- Personal request by an aviator for voluntary disqualification.
- Directed by HQDA or Chief, National Guard Bureau (NGB).

An FEB may be convened by the commanding general (CG) of the Active Army; CG, District of Columbia National Guard; and Active Army commanders in command of posts, camps, forts, stations, divisions, brigades, regiments, detached battalions or corresponding units of the Army.

Present policy in AR 600-105 states that when the appointing or a higher reviewing authority believes disqualification is proper, the report will be sent to the next higher reviewing authority for review. The appointing or any higher reviewing authority may take final action on the board proceedings when it restores aviation service.

Currently, when all reviewers recommend disqualificaton, regardless of the rank of the reviewer, the proceedings must be forwarded to Military Personnel Center (MILPERCEN) for final action. This review process is needlessly time consuming. All FEB proceedings, prior to arrival at MILPERCEN, have been reviewed by general officers. Effective with the revised AR 600-105 (scheduled for this month), when the appointing authority recommends disqualification, the approval authority will be exercised by the lowest level authority exercising general court-martial jurisdiction. In the event the appointing authority exercises such jurisdiction, approval authority will be exercised at that level. The Chief, National Guard Bureau, will approve all FEBs for Army National Guard aviators.

Heads Up!

The following shows the selection boards scheduled for 1983 and the months they convene:

Promotions

Lieutenant Colonel	**June**
Major	**May**
Captain	**June**
CW4 AUS	**September**
CW4 RA	**July**
CW3 RA	**July**
CW2 RA	**July**

Command

Colonel, Combat Service Support	**September**
Colonel, Combat Arms	**October**
Colonel, Combat Support Arms	**October**
Lieutenant Colonel, Combat Arms	**November**
Lieutenant Colonel, Combat Support Arms	**November**
Lieutenant Colonel, Combat Service Support	**November**

Service School/Project Manager

Senior Service College	**August**
Command and Staff College	**October**
Project Manager	**October**

Do not forget to check your records. Check your height/weight data as well as the physical date on your Officer Record Brief. Board members know that aviators are required to take annual physicals. Your full photo will go before the board rather than the microfiche copy, so be sure you present the best possible appearance. See AR 640-30 for details.

The following Hotline numbers can be called on official business after duty hours. They will be updated and reprinted here periodically for your convenience. If your agency has a Hotline it would like included, please send it to *Aviation Digest*, P.O. Drawer P, Ft. Rucker, AL 36362.

	AUTOVON	Commercial
Aviation		
Ft. Rucker, AL	**558-6487**	**205-255-6487**
Engineer		
Ft. Belvoir, VA	**354-3646**	**703-664-3646**
Field Artillery		
Ft. Sill, OK—ARTEP	**639-2064**	**405-351-5004**
Redleg	**639-4020**	**405-351-4020**
Infantry		
Ft. Benning, GA—ARTEP	**835-4759**	**404-545-4759**
Intelligence		
Ft. Huachuca, AZ—Training	**879-3609**	**602-538-3609**
Maintenance and Supply		
Tobyhanna Army Depot, PA	**795-7900**	**717-894-7900**
Missiles and Munitions		
Redstone Arsenal, AL	**746-6627**	**205-876-6627**
Ordnance (Help Line)		
Aberdeen Proving Gnd, MD	**283-4357**	**301-278-4357**
Quartermaster		
Ft. Lee, VA	**687-3767**	**804-734-3767**
Signal		
Ft. Gordon, GA	**780-7777**	**404-791-7777**
Transportation		
Ft. Eustis, VA	**927-3571**	**804-878-3571**
Turbine Engines		
Corpus Christi Army Depot, TX	**861-2651**	**521-939-2651**

VIEWS FROM READERS

Editor:

I'm interested in keeping up with the current events within Army Aviation even though my Branch is Infantry, and my age of 37 restricts me from applying for flight training.

I would appreciate it if my name could be added to your mailing list to receive the *Aviation Digest.*

Thank you for your time in reading and answering this letter.

2LT Richard G. Mansfield, USAR
Ringgold, GA

• Your unit should be able to obtain distribution for you and others in your unit by submitting DA Form 12-5 in accordance with instructions on the form. Private annual subscriptions can be obtained by submitting a remittance of $26.00 to: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Editor:

Captain Wright [Reporting Final, October 1982 *Aviation Digest*] is not the only female aviator rated as a Chinook pilot. Although she is assigned to C Company (AVIM), 34th Spt Bn, 6th Cav Bde (AC) and is not currently flying the Chinook, Captain Beth Garrity is CH-47 rated. She is presently doing a super job as a Direct Support Maintenance Platoon Leader and I'm certain she'll do just as well when she "STRAPS ON" one of those two headed machines.

CPT Robert G. David
6th Cav Bde (AC)
Ft. Hood, TX

Editor:

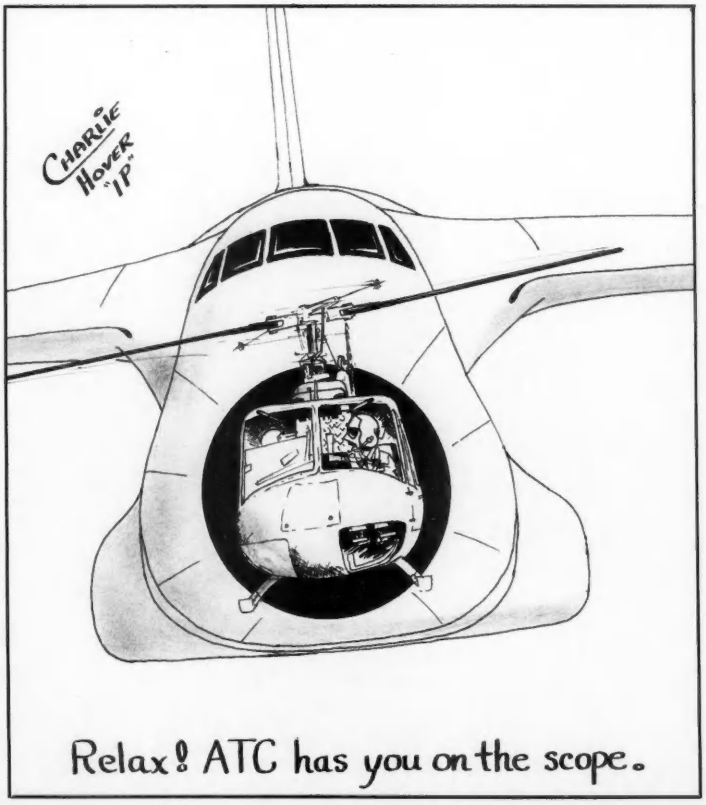
Request two copies each of Part One thru Part Five of the five part series "Forty Years of Army Aviation."

CW3 J. L. Nance
TSARCOM

Editor:

Request one copy of the complete [Army Aviation Systems Program Review] series.

MAJ Jeffrey W. Wright, MI
330th EW Avn Co (FWD)



Articles from the *Aviation Digest* requested in these letters have been mailed. Readers can obtain copies of material printed in any issue by writing to: Editor, *U.S. Army Aviation Digest,* P.O. Drawer P, Ft. Rucker, AL 36362

Editor:

Please find enclosed a poem that I've written along with artwork of the aircraft I've described in the poem.

If you find them suitable for publication, I would be honored as my fascination with the capability and sophistication of the AH-64 Apache is what compelled me to create both the poem and picture.

Keep up the good work.

Gregory D. Bruce
Army Aviation
Warrant Officer Candidate

APACHE

I take the name of a fearless tribe;
Nap-of-the-earth I do dare glide;
Masking, unmasking, remasking in stride;
Apache, Apache is king of the skies!

Laser target designation;
Deadly, silent illumination;
Total enemy obliteration;
Apache-style elimination!

Seeking quarry night and day;
Helmet sights engaging prey;
HELLFIRE armed and on the way;
Apache the victor, as always, today!

In any weather, over all terrain;
Thru heat or snow, fog or rain;
Futuristic warfare without strain;
Apache is king of its domain!

Turning The Corner

HAS ARMY AVIATION finally recovered from last year and turned the corner in its accident prevention program? Have the aviators and their supervisors at last come to grips with their responsibilities to the total aviation program? The Department of the Army has a strong interest in the problem, plus an acute awareness of the roles of aviators and supervisors in aviation accidents, and has charted positive courses of action to improve the aviation accident prevention program.

The accident investigators and analyzers tell us that the Army recorded 59 Class A accidents in fiscal year (FY) 1982. This computes to an accident rate of 3.7 per 100,000 flying hours—a dramatic increase from last year's 2.6 and the highest rate since 1973. The accidents spanned the entire fleet of Army aircraft and were spread across all levels of aviator experience.

The most revealing and troublesome bit of information was the fact that 42 of the 59 Class A accidents involved crew or supervisory errors.

FLIGHT CREW ERRORS
- Faulty judgment
- Violation of regulations or flight discipline
- Failure to follow established procedures
- Inattention to tasks
- Pilot-induced loss of control

SUPERVISORY ERRORS
- Failure to provide adequate training
- Failure to correct actions of subordinates
- Failure to provide guidance
- Failure to ensure IP qualifications
- Failure to take corrective action

The list of flight crew and supervisory errors hints strongly of numerous failures to follow standardized procedures. Such failures can be charged to both flight crews and supervisors.

A good example is an accident discussed in FLIGHTFAX, 27 October 1982. The mission was administrative, not tactical. Yet the aviator was flying at cruise airspeed about 100 feet above a bay and hit two wires which severed the tail rotor drive shaft. He managed to reach the shore where the aircraft began to spin due to low airspeed and crashed. This pilot had been counseled on two previous occasions for unauthorized low level flight. Here is a prima facie case of violation of regulations and flight discipline. The information also indicates a failure on the part of supervisors to correct the actions of the subordinate. This aviator had been "caught in the act" on three occasions—how many other times he displayed total disregard toward regulations, flight discipline and standardized procedures, is not known, but enough is enough. Draconian measures are sometimes necessary to set an individual straight, and in this instance were not applied.

In FLIGHTFAX, 15 December 1982, "Supervisory error: Failure to ensure instructor pilot (IP) qualifications" was evident in the case of an IP conducting high altitude training. The pilot of a UH-1 Huey ran out of left pedal during a landing attempt in mountainous terrain. After the aircraft yawed to the right, a go-around was executed. A second approach for landing was attempted; the aircraft again yawed to the right (full left pedal applied), but when the pilot attempted to fly out of the turn, rotor rpm was lost. The IP got on the controls, but it was too late for corrective action and the aircraft crashed. The IP had no high altitude experience during the preceding 6 years and had not received a high altitude checkout before assuming IP duties. While supervisory error has been cited as the dominant factor in this accident, the IP's judgment and actions, plus his inattention to standardized procedures, must also be taken into consideration.

- The IP accepted the mission when he knew that he was not current and qualified to perform IP duties in this instance.
- The IP did not caution against a second attempt to land after the first attempt indicated possible power and control deficiencies.

• The IP's ability to correctly compute a PPC (performance planning card) or to use the data properly is questionable under the circumstances.

• The acts of omission by both the supervisor and th IP, as they proceeded toward this accident, indicate a severe breakdown in the unit's standardization program. Furthermore, the monitoring of IP duties and qualifications by the installation standardization committee is suspect in this case.

Army Aviation becomes more complex with every passing day. The number of tasks and maneuvers and qualification requirements has increased dramatically over the years. The demands on the supervisor and the IP have also increased. A viable standardization program can be an excellent tool for simplifying the complex and easing the demands placed upon the supervisor and the IP.

The supervisor cannot be expected to know every detailed qualification of every one of his aviators. The IP on the other hand is aware of his qualifications and has a responsibility to keep his supervisor informed, especially when assigned a mission for which he knows he is not current and qualified.

The purpose of this article is not to disagree with the conclusions as stated in FLIGHTFAX, but to show the interrelationship of the aviator and the supervisor in the accident prevention effort. Together they have been responsible for more than 70 percent of Class A accidents in FY 1982. Together they have the wherewithal, through a dedicated standardization program, to turn the corner on aviation accident prevention and to still come up with a banner year in the remainder of FY 1983.

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362; or call us at AUTOVON 558-3504 or commercial 205-255-3504. After duty hours call Ft. Rucker Hot Line, AUTOVON 558-6487 or 205-255-6487 and leave a message

CONNECTION

ACTAAT

Aviation Center Training Analysis and Assistance Team

Instrument Flight Examiner Course

ISSUE: Recent graduates of the IFE Course indicated that the course would be far more beneficial if academic instruction was conducted at the beginning of the course rather than conducted during the flight portion of the course. Perhaps a correspondence program could be established to allow students to prepare for the course prior to attendance.

COMMENT: Academic instruction is scheduled throughout the IFE Course to complement the flight line instruction and effectively use the total training day, i.e., flight line in the morning and academics in the afternoon. If resources permitted, academics could be scheduled to occur anywhere in the course flow; however, the current 50-50 mix of academic and flight instruction most effectively uses our limited resources and keeps the course length within the current number of authorized training days.

The limited number of students that attend the IFE Course does not justify the expenditure of resources required to develop and maintain a correspondence program for this course.

Courses of instruction, lesson plans and programed instruction materials for the IFE Course are available from the U.S. Army Aviation Center. These references are listed in the Department of Academic Training Catalog of Instructional Material which may be requested by notifying the Commander, U.S. Army Aviation Center, ATTN: ATZQ-T-A-T-E, Ft. Rucker, AL 36362. Information concerning instrument flight procedures can be found in the Airman's Information Manual and Federal Aviation Regulations published by the Federal Aviation Administration/Agency and available through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Additional information can be found in FM 1-5 and AR 95-1.

Mr. Edward J. Bavaro
Threat Section
Directorate of Combat Developments
U.S. Army Aviation Center
Fort Rucker, AL

"WHY ME?" — *THE THREAT OFFICER*

CLOSING THE DOOR to the commanding officer's office behind him, WO1 Peter Pilot adjusts his hat and proceeds past the first sergeant's desk and out to the parking lot. Visibly unhappy, Pete is thinking to himself, "Why me? Here I am, just out of Ft. Rucker and the Cobra transition, my first aviation assignment, and they make me the unit threat officer. Jeez, I want to fly, I don't want to teach classes on stuff I don't know anything about. I don't know what to do, where to start...What the heck am I going to do?"

Know the situation? This kind of scenario is not uncommon and, for aviators, additional duties have always had special significance, especially at OER (officer evaluation report) time. Well, what can someone like WO1 Peter Pilot do? How can he prepare himself?

For starters, get with your operations/training officer who should be able to translate the general guidance the commander gave you into specific requirements. The operations/training officer has many responsibilities, not the least of which is the combat readiness of the unit. Any training program that does not incorporate a realistic threat presentation, that does not challenge the crews to contend with a simulated threat array, is a training program without real substance. The best pilots in the world, highly skilled in gunnery, would suffer if they were incapable of coping with threat air defense systems. As the threat officer, you can play a very important role in helping to achieve *meaningful* combat readiness. Hopefully, the operations/training officer is already motivated in that direction, but as you yourself become more knowledgeable, you may need to push and prod the threat training effort. In any case, you now have direction. What you need next is information.

Go to the battalion S2 and make friends with his staff. You'll be working closely with them if you want to be effective in your job. See what is available; learn what you can; establish yourself as a customer on the S2's distribution list; and learn what sources you can directly communicate with to get information, threat literature and training aids. From here on, you can expect to be handling some classified material and developing your own portfolio. Learn what your responsibilities are for safeguarding and handling classified documents.

Next, visit and meet the G2 people. They may have a more extensive library of documents than the S2. Again, make friends here and become a regular visitor with access to their data. Learn who their sources are and what kind of support can be provided in developing your own reference material.

Now you have the means to get your program started and on its feet, but you really have only just begun. The real work now has to be done. How good a threat officer you are, or will become, depends on your initiative and drive. You have to aggressively push a threat awareness program by exposing the pilots to a barrage of threat data. This information (unclassified) should appear in appropriate areas such as briefing rooms and flight planning rooms and should show the air defense systems and potential threat targets. These displays must be maintained, updated and reviewed frequently to ensure they do not become mere visual litter. Procure and make available supportive literature, recognition manuals and other threat reference data that will help to stimulate the interest of the pilots. Regularly scheduled classified presentations detailing the characteristics, strengths and weaknesses of the various threat systems must be provided in an effort to make the aircrews as conversant and familiar with them as they are with their own aircraft and weapon systems. Now you're cooking, but you can't stop here.

This is the place where most units fall short on their threat training. Oh, sure, the unit pilots can tell you all about the ZSU-23-4, the technical characteristics of the SA-7, SA-8 and so forth, but have they made application out in the flight training area? Have they practiced, refined and rehearsed the choreography of target identification, designation, suppression, evasion and attack? A lot of units show great marksmanship on the range, fly nice nap-of-the-earth and demonstrate outstanding touch peforming emergency procedures at the airfield, but how many have operated against a simulated threat array in field exercises?

What about air-to-air engagements? How do they handle electronic countermeasures? The possibilities are extensive and certainly it is not going to be easy to simulate the actual environment of the battlefield, but this is exactly the type of stimulating and challeng-

ing training we should be striving to develop at the unit level.

An Israeli helicopter pilot, fresh from the fighting against Syrian forces in Lebanon, stressed the necessity of realistic training so that it approximates the confusion of the battlefield where rapid decisions are required. The November 1977 Air Combat Engagement Program test showed that in simulated engagements response time was less than 10 seconds after detection, with the advantage going to the aircraft that was first to place fire on the other guy.

The Army is developing promising force-on-force training simulation systems such as the Multiple Integrated Laser Engagement System and a multipurpose range complex. But, in the meantime, aviation units will have to continue trying to infuse realism into tactical flight training. Even if these training systems become a reality, other innovative applications should not be discouraged. The threat officer should figure prominently in these efforts.

Combat readiness is the aim of any training program. But, combat readiness for those that will be directly involved in the fighting has special significance. Achieving combat readiness that is meaningful and realistic will require the cooperation and dedication of the entire unit. The importance of the threat officer in this effort cannot be overstated. You really hold one of the more important additional duties in the company.

The only thing left is for you to develop your own unclassified reference library. The list of recommended publications in the accompanying box will assist you in establishing a representative library. Trade and technical publications such as *Aviation Week and Space Technology, International Defense Review* and *Interavia* are excellent sources of information. Military publications (e.g., Ft. Knox's *Armor,* Ft. Benning's *Infantry*) provide outstanding presentations highlighting threat equipment. The *Aviation Digest* features a monthly threat section which gives a comprehensive picture of the threat to Army Aviation. The U.S. Army Aviation Training Library at Ft. Rucker publishes a threat bibliography available to anyone and the OPFOR (opposing force) training detachment at Ft. Hood puts out an informative *Red Thrust Star* newsletter as well as scripts and slides on various subjects.

As you can see, the tools to help you as the threat officer are available and plentiful. The only element that really matters, however, is the interest and drive that you—the concerned, conscientious threat officer—apply. It may take different approaches (cajoling, spoon-feeding, threatening) to educate your unit's pilots on threat. In most cases, though, you will find that pilots really want to know, and your sincere efforts will be rewarded with the satisfaction of knowing the role you played in their combat readiness.

Recommended Publications

1. AR 380-5
   See DA PAM 310-1.
2. FM 1-2
   FM 1-88 (New issue due in early 1984)
   See AR 310-2 and DA PAM310-3. Get with publications clerk and ensure you have established DA Form 12-4 and 12-5 accounts and that they reflect your needs.
3. TB 381-5 series (FOMCAT)
   See DA PAM 310-4 (some volumes are classified).
4. FM 100-2-1, "Soviet Army Operations and Tactics";
   FM 100-2-2, "Soviet Army Specialized Warfare and Rear Area Support";
   FM 100-2-3, "Soviet Army Troops, Organization and Equipment"
   Send request to: CDR, USACADA, ATTN: ATCA-DLT, Ft. Leavenworth, KS 66027, AUTOVON: 552-4472.
5. Operator manuals:
   AK-47
   BTR-152
   BTR-150
   OT-62
   BMP
   T-62
   Technical Intelligence Bulletins
   Write: CDR, USAITAC, ATTN: IAX-I-T, Arlington Hall Station, Arlington, VA 22212.
6. Defense Intelligence Agency:
   DDI-1100-77-76
   DDI-1100-128-76
   DDI-1100-143-76
   DDI-1120-129-76
   DDI-2680-32-76
   DDI-1100-155-77
   DDI-1100-159-77
   DDI-1150-13-77
   DDI-2200-33-77
   DDB-1100-164-78
   DDB-1100-197-78
   DDB-1100-200-78
   DDB-1300-128-78
   DDB-2680-40-78
   DDB-2680-48-78
   DDB-1100-161-78
   DDB-1120-12-79
   DDB-1150-18-79
   DDB-1300-147-79
   DDB-1110-1-79
   DDB-1300-153-79
   DDB-1100-241-80
   DDB-2680-62-79
   DDB-1200-146-80
   DDB-1140-6-80
   DDB-1600-5-80
   DDB-1100-255-80
   DDB-1120-10-80
   RSGF1-77
   RSGF2-77
   RSGF1-78
   RSGF1-79
   RSGF1-80
   RSGF2-80
   RSGF3-80
   RSGF4-80
   To save space, only document numbers are provided. To obtain a list of unclassified DIA publications write: CDR, USAITAC, ATTN: IAX-M-D, Arlington Hall Station, Arlington, VA 22212, AUTOVON: 222-6740. These publications are available from: AG Publications Center, Baltimore, MD 21220. See DA PAM 310-10-2 on procedures to fill out DA Form 4569.
7. CDR FORSCOM
   OPFOR Trng Det., P.O. Box 5068, Ft. Hood, TX 56544, AUTOVON: 737-3014/3316
   In addition to their RED THRUST STAR newsletter, they provide information, advice and assistance on OPFOR.
8. U.S. Army Aviation Training Library, P.O. Drawer O, Ft. Rucker, AL 36362, AUTOVON: 558-5014/4591
   Offers outstanding service and specializes in Army Aviation; publishes threat bibliography and will support requests directly or through interlibrary system. Send for the guide to its services and threat bibliography.
9. *U.S. Army Aviation Digest* (monthly threat section)
   Official distribution is available by submitting DA Form 12-5 in accordance with instructions on that form. Or, annual subscriptions are available by sending a remittance of $26.00 ($32.50 for overseas) to: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

Mast Bumping

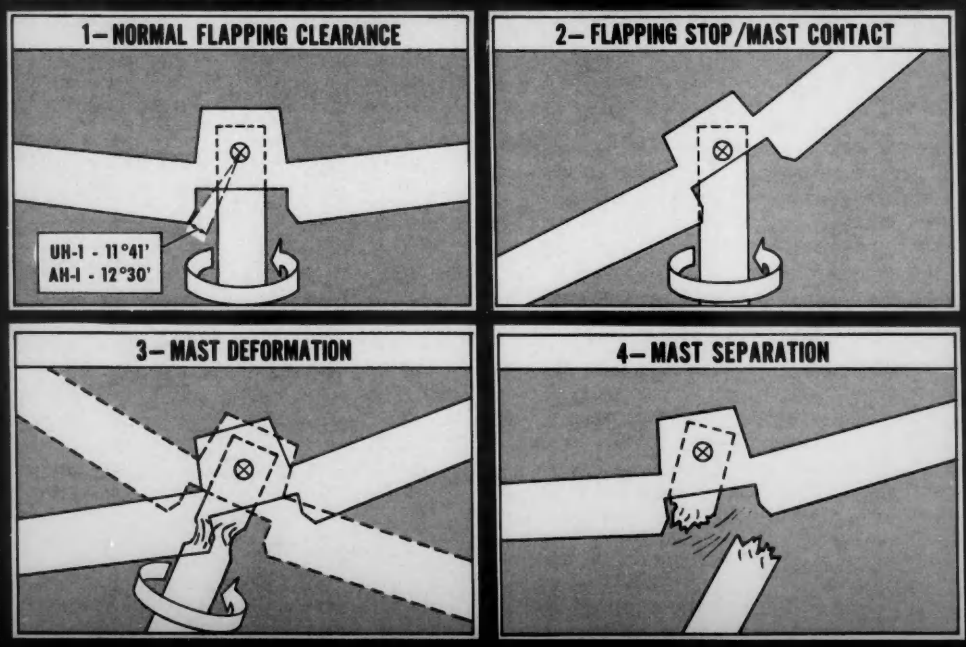
causes and cures

Rotor separation due to mast bumping

Mr. G. Thomas White
Applied Technology Laboratory
U.S. Army Research and Technology Laboratories
(AVRADCOM)
Fort Eustis, VA

THE IN-FLIGHT mast bumping phenomenon is a problem associated with the UH-1/AH-1 series helicopters. The problem involves the dynamic contact of the main rotor hub with the mast as the maximum "teetering" or flapping angle of the rotor is exceeded (figure 1). This phenomenon is inherent in the teetering rotor system if inadvertently operated outside the prescribed flight envelope or in the critical flight conditions illustrated in figure 2. In addition, some of the control techniques required to correct abnormal aircraft attitudes or extreme blade flapping that may occur during tail rotor failures, tactical sideslip maneuvers, low rotor rpm (revolutions per minute) conditions or rapid evasive maneuvers including pop-ups

FIGURE 1: Rotor mast separation sequence



and low-G flight may be counterinstinctive and could be misapplied in either combat or true emergency situations, thus increasing the chances for mast bumping. If the contact is severe and repetitious, local mast deformation can occur. This may further result in mast separation as the driving torque of the engine wrings the mast in two.

Accident data from the U.S. Army Safety Center, Ft. Rucker, AL, indicates a long-term recurrence of this particular accident sequence, thus prompting the Army's interest in its investigation and resolution. Since 1967 a significant number of mast/rotor separations have occurred in Army UH-1 and AH-1 series aircraft. These separations resulted in 59 accidents and 213 fatalities for the years 1967 through 1982 as illustrated in figure 3. These statistics do not, however, indicate any such long-term mast bumping or separation problem with the OH-58 helicopter. In fact, no mast separation on OH-58 type aircraft has been recorded in Army accident statistics during the above period. One might only speculate that this seemingly noninvolvement may be attributed to perhaps less severe mission-required maneuvers, less opportunity for center of gravity extremes and/or lower inertia fuselage than either UH-1 or AH-1 type aircraft, and thus the OH-58 is more responsive to cyclic control commands.

Statistics of in-flight mast bumping on the current 59 rotor separation accidents indicate that the initial step in the accident sequence stemmed from:

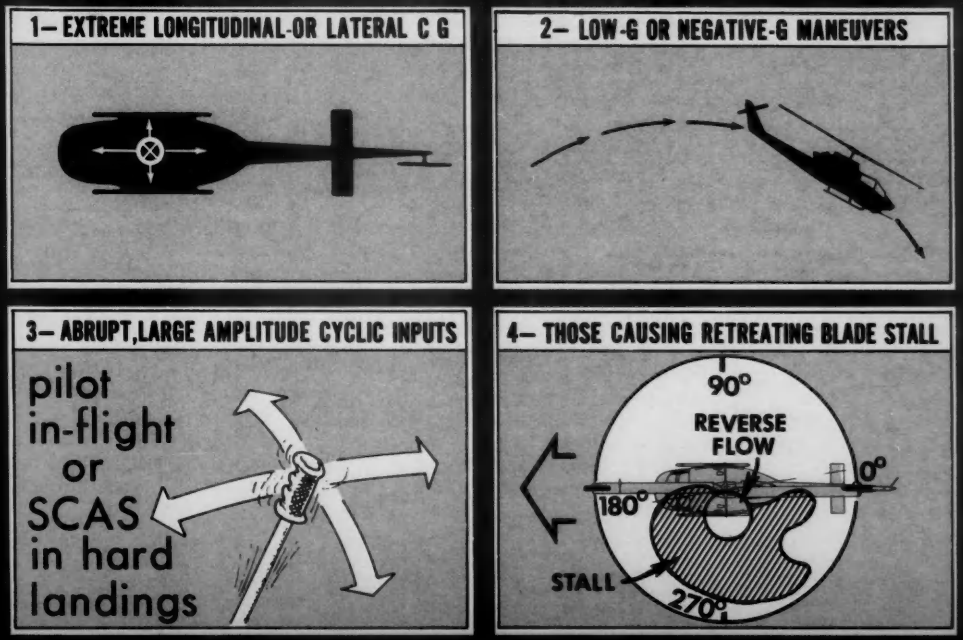
Engine failure	**2%**
Transmission failure	**3%**
Tail rotor failure	**12%**
Elevator failure	**2%**
Mechanical failure	**23%**
Low-G maneuvers	**5%**
Weather or turbulence	**17%**
Crew	**5%**
Unknown	**29%**

The Army Safety Center reports no Army aircraft mast separations in 1979 and 1980, one in 1981 and two in 1982. It is obvious that the problem has not disappeared and remains an operational caution area with all teetering rotor aircraft.

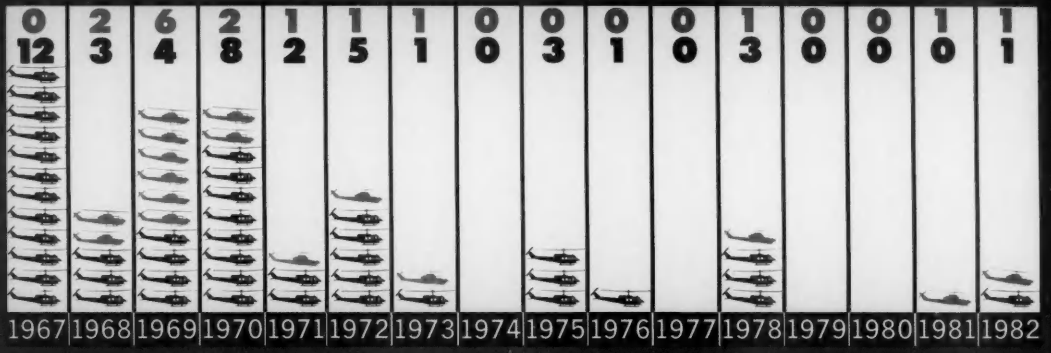
A multiple approach has been followed to cure or at least reduce the occurrence of mast separations. Improved pilot awareness has been pursued with the publication of various articles and safety bulletins including two articles in the *Aviation Digest* in 1974 and again in 1977[1] about mast bumping. Also, a con-

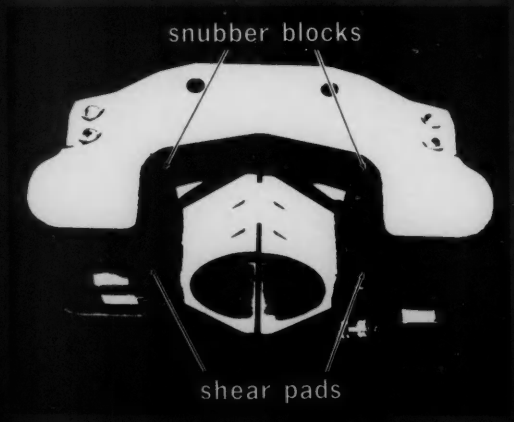
[1]A training film is now available through your normal audiovisual channels entitled, "Mast Bumping—Causes and Prevention," TF46-6077

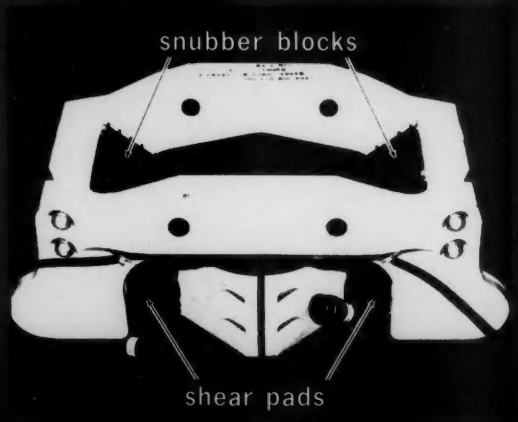
FIGURE 2. Large flapping amplitudes can occur in these critical flight conditions



Mast Bumping
Causes and Cures







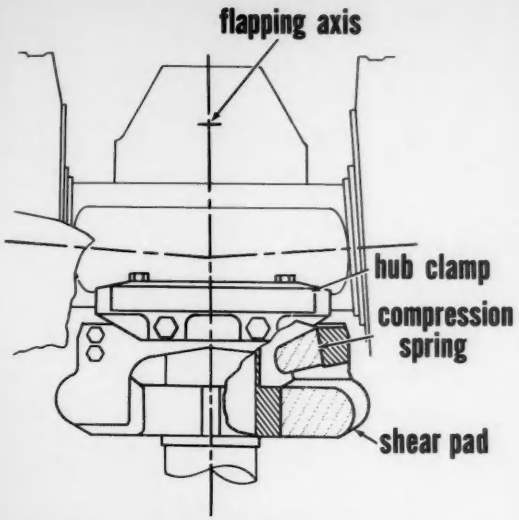


FIGURE 6: UH-1H nonlinear hub spring

solidated engineering recommendation was reached by U.S. Army Aviation Research and Development Command (AVRADCOM) (formerly AVSCOM) on 26 November 1974 to replace, through attrition, all thin walled masts on UH-1B, C, D, H and M aircraft with thicker walled masts to increase the ability of the mast to withstand rotor hub bumping loads. It was later determined that plugs could be inserted in the existing thin walled masts to provide increased stop contact yield strength prior to thick wall mast retrofit. The mast plug MWO (modification work order) was authorized in August 1978. However, neither of these fixes was expected to totally cure mast separation nor would they prevent mast bumping. These fixes were to provide additional protection if mast bumping occurred. They increase the ability of the mast to absorb more punishment before failure. This apparent additional safety margin is not all that it may seem at first glance, however. One should note that the original AH-1 mast was replaced in 1968 with a thicker wall mast to carry the high torque load. While it is not known exactly how many AH-1 aircraft suffered mast separation with the thick wall mast, the Army Safety Center indicates that a preponderance, if not all, of the recorded AH-1 losses involved the thick wall mast. In view of the aerodynamic and inertia forces involved, the thick wall mast is just as prone to separation as the thin wall. The mast wall thickness increase is only 0.08 inches.

A multiphased R&D (research and development) effort was undertaken in 1975 by the Applied Technology Laboratory, Ft. Eustis, VA, to develop a long-term solution to reduce and perhaps eliminate the occurrence of mast bumping and rotor separation on the UH-1 helicopter (figure 4). This effort was completed in April 1981 with the documented design and flight test of what is called a nonlinear hub spring, figure 5.[2] The significant difference between the hub-spring approach and the plug/thick-wall-mast approach lies in the hub spring's reduction of the tendency of the hub to bump the mast through the use of a restoring spring force about the flapping pin. That is to say, the rotor flapping or "see-saw" angles are reduced for comparable control motions. The hub spring, shown in schematic in figure 6, combines two elastomeric characteristics. First, the linear spring rate shown in figure 7, characteristic of the four elastomeric shear pads of the hub-spring assembly, provides modest hub restoring moments throughout the flapping spectrum. Second, for flapping angles greater than 4 degrees the rubber snubbers are cyclically compressed against the mast sleeve which generates the additional nonlinear hub moment; more flapping, more compression and thus more restoring moment along the nonlinear curve. (The UH-1 encounters flapping values of 4 degrees or less during 90 percent of its mission time.) If bumping does occur, it is through a rubber stop rather than metal-to-metal contact, thus significantly reducing the probability of structural damage to the mast. Of the 59 mast separation accidents listed in figure 2, it is estimated that the hub spring could have been instrumental in reducing the severity of the accidents in 60 percent of the cases.

The time and expense devoted toward the development of the hub spring solution to the mast bumping problem is considered by AVRADCOM to be a positive contribution to the service life extension of the UH-1 fleet. Of about 3,500 UH-1Hs in the Army inventory, there remains a requirement to retain about 2,700 UH-1Hs after fielding the planned 1,107 UH-60 Black Hawks. Further, the disclaimer that flight outside the envelope is seldom if ever intentionally performed is not a fail-safe rebuttal to the hub spring. Experience has shown that flight outside the published operational envelope will occur during periods of accelerated pilot training and combat. Operating conditions that are *within* the recognized UH-1 flight envelope may cause high flapping and mast bumping depending on the individual pilot's reaction to certain situations. Situations such as start-up and shut-down

[2]Technical Report USAAVRADCOM-TR-80-D-27, Holfield, P., Dooley, L., VanGassbeek, J., April 1981.

Mast Bumping
causes and cures

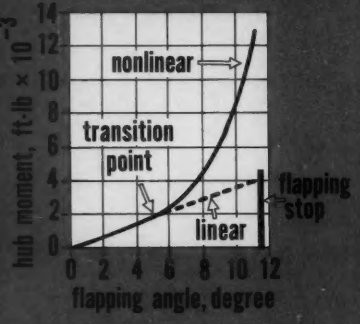


FIGURE 7: Hub moment provided by nonlinear hub spring

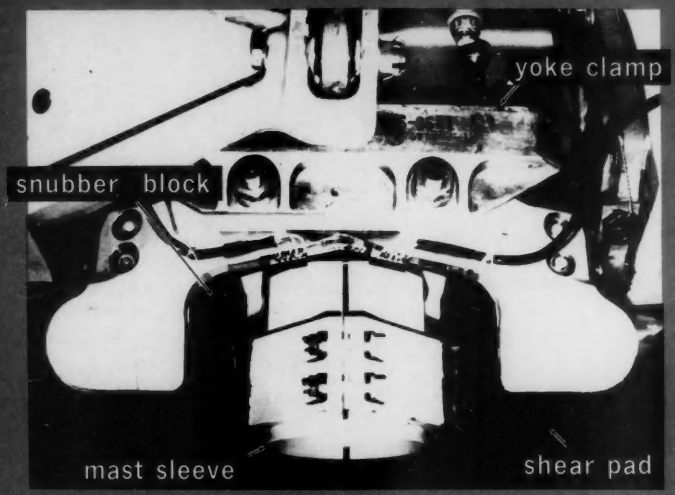


FIGURE 8: UH-1H nonlinear hub spring attached to main rotor yoke

in high wind conditions, IMC (instrument meteorological conditions) including turbulence and positive low-G maneuvers are suspect. Then too, the failure of certain critical components (e.g., tail rotor or engine) will cause the collapse of the normal operating envelope to within perhaps intolerable limits.

The hub spring shown installed on the UH-1H hub in figure 8 was developed specifically as a field-retrofit item for the UH-1H hub assembly. In principle the same device could be applied to the AH-1 series aircraft with simple modification to the elastomer or rubber composition for the desired spring rates, and design of an alternate spring attachment scheme for the AH-1 hub. The implementation of the hub spring concept is not, however, exclusive to the UH-1H. Bell Helicopter has demonstrated previous hub spring experience as reflected in flight demonstrations of the model 206 Jet Ranger with elastomeric flapping bearings and torque tube type hub spring, the model 408 advanced attack helicopter with torque tube flapping bearing, the model 309 King Cobra with torque tube hub spring, the model 214 transport helicopter with nonlinear hub spring and the model 222 with a linear hub spring.

UH-1H hub spring flight test data indicates that the nonlinear hub spring provides a mast bumping safety margin as evidenced by the following general benefits:

- Reduced main rotor flapping in steady state flight and maneuvers.
- Pilot warning of critically high flapping through inherent low vibration feedback.
- Increased distribution of mast bumping loads during contact.
- Enhanced high-wind start-up and shut-down characteristics of the rotor.
- Increased center of gravity range.
- Increased control power during low-G flight.
- Some improvement of control margins, static stability, damping and controllability.

Army rotary wing aircraft need a built-in safety margin for NOE (nap-of-the-earth) agility/maneuverability situations wherein the pilot's attention is concentrated on mission accomplishment in the combat "complexity" environment. An engineering solution is available to significantly improve the mast bumping weakness of the UH-1 teetering rotor system. Whether or not the hub spring will be introduced into fleet service will be based on a "user perceived" safety or performance requirement and the overall economics involved with a major retrofit on an aging but serviceable "Huey" fleet.

MONTHLY WRITING AWARD

U.S. Army Communications Command
ATC ACTION LINE

Want to become an old pilot?

Mr. Kenneth S. Arnold
U.S. Army Air Traffic Control Activity
Aeronautical Services Office
Cameron Station, Alexandria, VA

JUST RECENTLY I talked with a CW4 who was retiring after a career of more than 30 years. During his long flying career, he had never broken an aircraft in any way.

I thought, "Here is my chance to find out how he accomplished this feat." I asked him for the secrets of his success. After I had convinced him that I seriously wanted to know, he gave me his secrets:

- Learn good habits early.
- Be lucky enough to have the best instructors early in your flying training.
- Fight complacency with all your might.
- Don't ever assume anything.

When I asked him to elaborate a little, he admitted that he had probably learned good habits early in his career, because he had been lucky in having excellent instructors who taught him those good habits. "Complacency, on the other hand, is a battle all your own. To become an old pilot, one must avoid getting in ruts. Where the same flight crews fly together day after day, trade off performing duties such as filing flight plans and preflight inspections. Be sure that each individual understands what his/her responsibility is for that particular mission. Never assume anything!"

Later, the danger of assuming was further amplified by a Navy pilot who also retired without an accident or incident to discredit him. To illustrate, he related a war story about being number two in a flight taking off in conditions where visibility was limited to half the runway length. The first aircraft had begun its takeoff roll and soon disappeared in the soup.

My story teller revealed that he had not heard any transmissions and assumed number one had departed. He was about to begin his roll when something told him to check with the tower to see if number one had, in fact, made it OK. At that moment tower explained number one had aborted and was still on the runway. Number two Navy aviator promised himself at that moment that he would never again assume anything. To this day he believes that his adherence to that promise kept him alive and safe throughout a long career in Naval Aviation.

A wise old controller once said, "The major problem with communication is the assumption that it has been achieved." A "traffic at twelve o'clock" advisory answered by a crisp "roger" permits considerable controller latitude in assuming that the "roger" affirmed the sighting rather than mere receipt of the message. Perhaps the desire to verbally project the image of an assured, self-sufficient pilot may be a psychological block to transmitting a message that might connote doubt, puzzlement or need of assistance in handling any in-flight situation. So—the advice of the two old pilots above, "don't assume anything, " needs broadening to, "Don't force someone else to assume something."

Readers are encouraged to address matters concerning air traffic control to:
Director, USAATCA Aeronautical Services Office, Cameron Station, Alexandria, VA 22314

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On 14 April 1983, Secretary of the Army John O. Marsh Jr. announced his approval of the establishment of Aviation as a separate branch of the Army. Additionally, Secretary Marsh announced that Army Chief of Staff General E. C. Meyer has approved the centralization of proponency, or responsibility, for Aviation matters at the Army's Aviation Center at Ft. Rucker, AL.

General Meyer had earlier approved the two actions in concept as a result of a thorough study of the Army's Aviation requirements now and in the future. That study was conducted by the Army's Training and Doctrine Command at Ft. Monroe, VA.

In approving the centralization of Aviation proponency, General Meyer noted that, "Voids in Aviation training and training development, piecemeal development of Aviation doctrine and force structure, and the education and training requirements generated by equipment advances" mandated single responsibility for Aviation matters.

New battle doctrine for Army Aviation has broadened its role as a combat maneuver element. That doctrinal development and personnel management considerations, according to General Meyer, made formation of a separate Aviation Branch necessary.

General Meyer has directed the Army staff to give further study to the Training and Doctrine Command's Aviation implementation plan. That study will include personnel management, Aviation training, aviation logistics, budget and branch composition issues.

We're a branch!